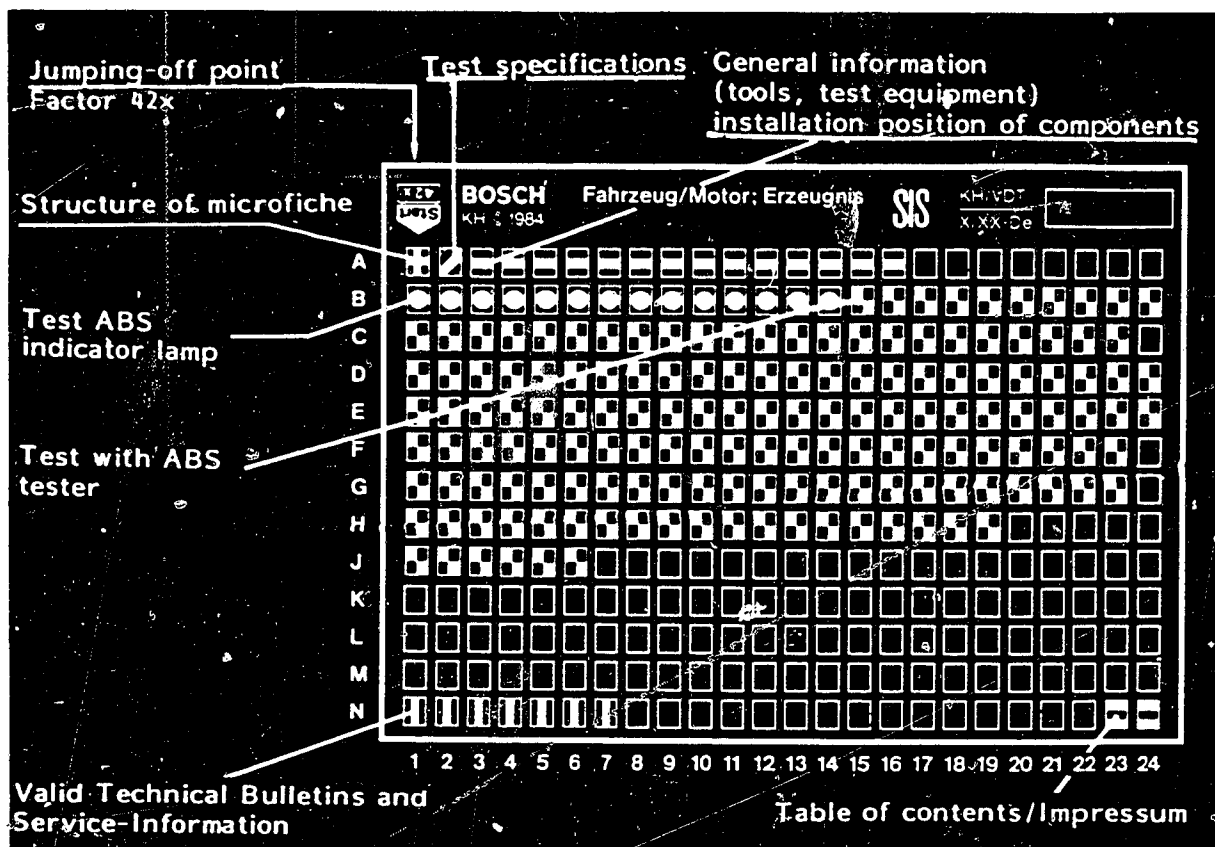


Structure of microfiche



1. Read from left to right
2. Title of microfiche (appears on each coordinate)

E16	Product/component/test step
	Vehicle/engine

Coordinate

3. Limits of section

Beginning	Mid-section	End	One-page section

4. Purely vehicle-specific passages in the text are marked with a vertical bar.
5. Reference to relevant working steps in the test specifications, e.g. coordinate C6.

C6

A1

Trouble-shooting program



1. TEST SPECIFICATIONS

For reasons of safety, the ABS must only be tested using the ABS tester.

The test program contains all the important information on testing and replacing the components.



2. TEST EQUIPMENT AND TOOLS

Description	Designation	Part No.
<u>ABS tester</u> Use only converted testers. Designation U2 on nameplate	ETT 016.00	0 684 101 600
<u>Dynamic brake analyzer</u>	e.g. BPS 100 or BPS 101 or BPS 104 or BPS 105	0 680 012 .. 0 680 013 .. 0 680 018 .. 0 680 019 ..
<u>Charging and bleeding device</u>		e.g. ATE Part No. 3.9302-1000.4 ¹⁾
<u>Bleeder connection for connecting charging and bleeding device to fluid reservoir of master cylinder</u>		ATE Part No. 3.9302-0702.2 ¹⁾
<u>Bleeder hose</u>		ATE Part No. 3.3590-2300.1 ¹⁾

- 1) Obtainable from:
 Alfred Teves GmbH
 Guerickestr. 7
 6000 Frankfurt/Main



Description	Designation	Part No.
<u>Auxiliary hose</u>		ATE Part No. 3.9302.0704.2 ¹⁾
<u>Brake pedal actuating device</u>		ATE Part No. 3.9312.0100.4 ¹⁾
<u>Pressure tester</u> Tester for low- pressure and high- pressure testing of hydraulic brake systems		e.g. ATE Part No. 3.9305.0200.4 ¹⁾
<u>Double-end flare nut wrench</u> 9 x 11 mm		Hazet Part No. 612 2)
<u>Vessel</u> for catching the brake fluid approx. 1 l		
<u>Brake fluid</u> Use only ATE genuine brake fluid DOT 4		
<u>Electrics</u> <u>tester</u> or <u>multimeter</u> for trouble- shooting	ETE 014.00	0 684 101 400 commercially available

¹⁾ Obtainable from:
Alfred Teves GmbH
Guerickestr. 7

6000 Frankfurt/M

²⁾ Fa. Hazet
5630 Remscheid

A4

Test equipment and tools
Porsche 928 S



2.1 Auxiliary materials

Use only Porsche genuine brake lines.

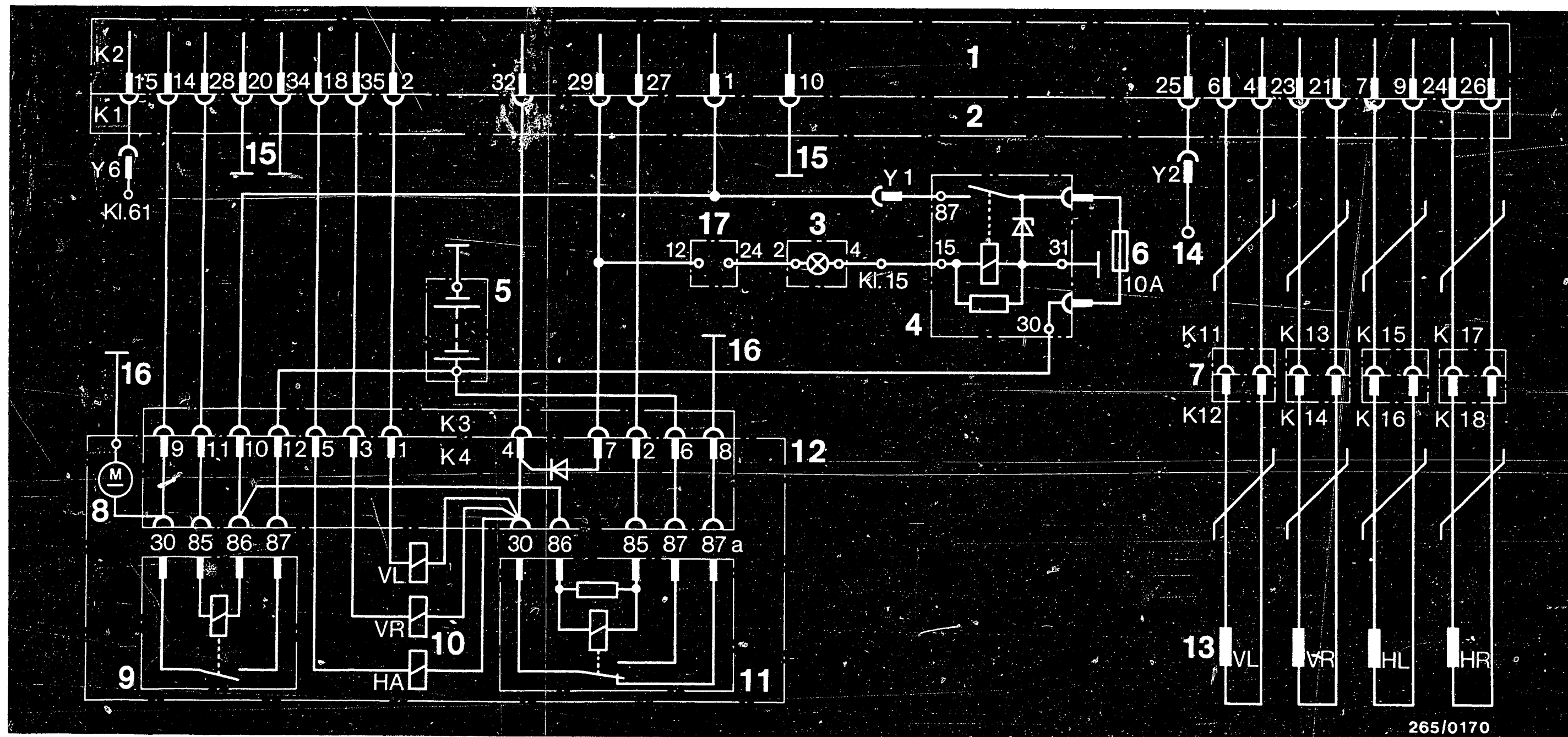
<u>Description</u>	<u>Part No.</u>
Grease for wheel-speed sensors	Molykote Longterm 2
Protective caps for brake lines	Bosch Part No. 1 900 508 002 (100 pieces)
Protective caps for connection of brake lines to hydraulic modulator	Bosch Part No. 1 900 508 004 (100 pieces)

A5

Test equipment and tools

Porsche 928 S





3. ELECTRICAL TERMINAL DIAGRAM

1 = Electronic controller
 2 = Multiple plug (35-pin)
 3 = ABS indicator lamp in instrument cluster
 4 = Overvoltage protection relay
 5 = Battery
 6 = Fuse

7 = Cable connector
 8 = Return-pump motor
 9 = Motor relay
 10 = Solenoid-operated valve
 11 = Valve relay
 12 = Hydraulic modulator

13 = Wheel-speed sensor
 14 = To stop-lamp switch (+)
 15 = Ground terminal steering bracket
 16 = Ground terminal on wheel house wall

17 = Central information panel
 VL = Front left
 VR = Front right
 HL = Rear left
 HR = Rear right
 HA = Rear axle

K1 to K18 = ABS plug-in connections
 Y1, Y2, Y6 = Connectors in central-electrics console

A6

Electrical terminal diagram
 Porsche 928 S



A7

Electrical terminal diagram
 Porsche 928 S

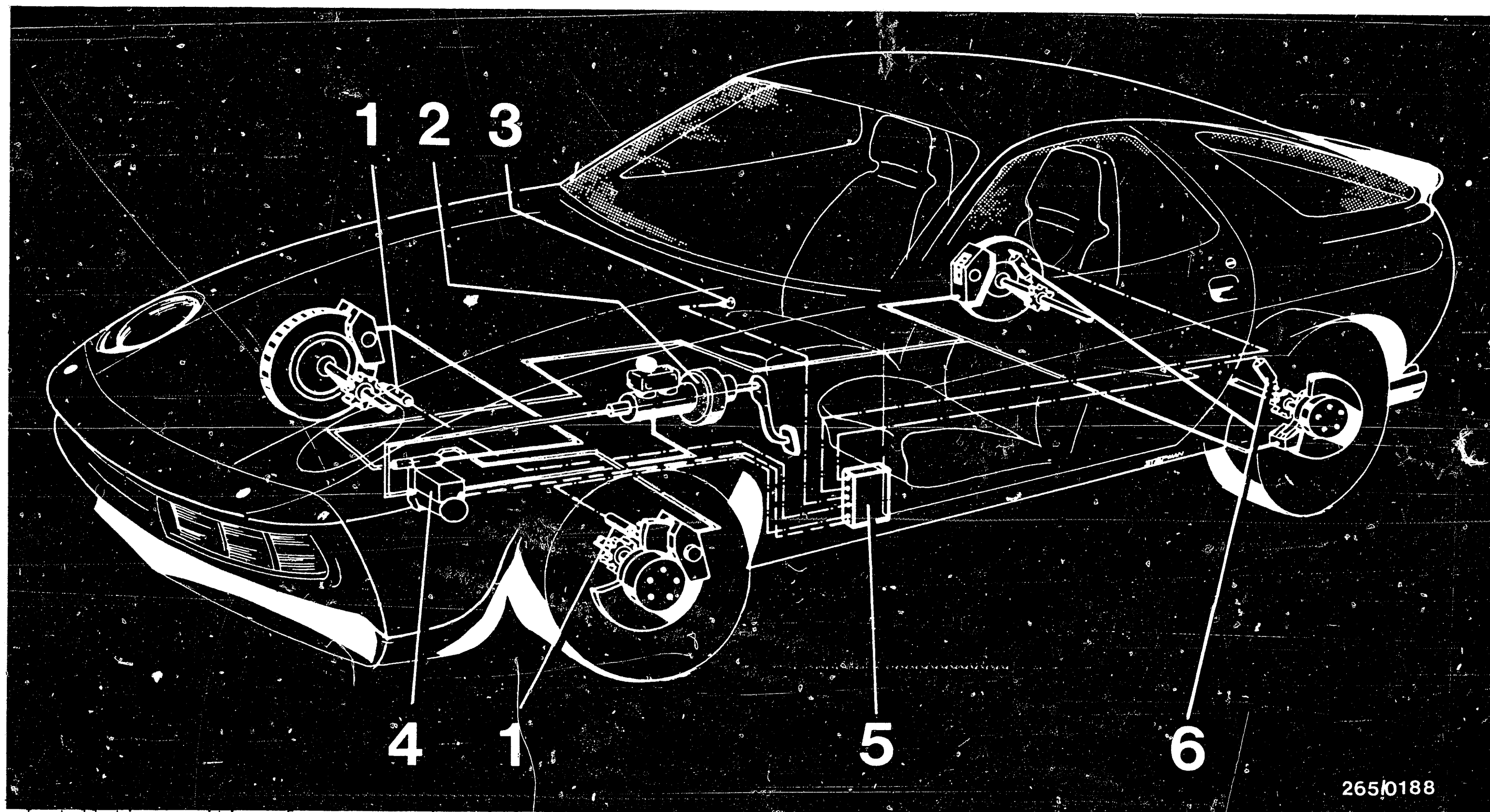


4. INSTALLATION POSITION OF COMPONENTS

The indications "left" and "right" always refer to the forward direction of travel.

- ABS indicator lamp: In instrument cluster.
- Front-axle wheel-speed sensors: One each on left and right in the steering knuckles.
- Rear-axle wheel-speed sensors: One each on left and right in the wheel carrier.
- Hydraulic modulator: In engine compartment at front left in a penetration of the wheel-house wall.
- Ground terminal for ABS: Under the steering bracket, near stop-lamp switch
- Controller: In driver's footwell on left above the lid release handle.
- Overvoltage protection relay: Relay no. 11 in central-electrics console.





265/0188

Installation position of components (continued)

- 1 = Front wheel-speed sensors
- 2 = Brake assembly with tandem master cylinder
- 3 = ABS indicator lamp

- 4 = Hydraulic modulator
- 5 = ABS controller
- 6 = Rear wheel-speed sensors

A9

Installation position of components
Porsche 928 S



A10

Installation position of components
Porsche 928 S



5. BLEEDING OF BRAKE SYSTEM

After replacing the hydraulic modulator, bleed brake system and perform high-pressure and low-pressure tests.

Take care when handling brake fluid!

- a) Only pour brake fluid into containers where there is no danger of accidental human consumption of the fluid (fatal dose 100 cm³).
- b) Even slight traces of mineral oil cause the brake system to fail. If the brake fluid is colorless or yellowish pay particular attention since in this case the danger of a mix-up is at its greatest. If mineral oil is detected in the brake system or if there is a suspicion of same, the entire brake system must be thoroughly rinsed with brake fluid. The brake master cylinder must also be replaced.
- c) Do not allow brake fluid to come into contact with the vehicle paintwork as it contains components which dissolve paint.
- d) Brake fluid is highly hygroscopic, i.e. it absorbs humidity thus reducing the boiling point. Thus, brake fluid may only be stored in thoroughly sealed containers.

Note:

In the course of its service life the boiling point of the brake fluid drops due to the continuous absorption of humidity from the atmosphere. Thus, vapor bubbles may form in the brake system if the brakes are subjected to extremely heavy braking conditions. The brake fluid must therefore be replaced annually, preferably in the spring.



Bleeding

- When using a bleeding device for bleeding, pay attention to the manufacturer's operating instructions. In order to eliminate all air bubbles from the tandem brake master cylinder, the brake pedal must be completely depressed at least three times during the bleeding process with the bleeder screws open.
- If bleeding is performed by "pumping" with the brake pedal, close the appropriate bleeder screw each time before releasing the brake pedal to prevent air from being sucked in via the thread of the bleeder screw.
- Slowly release brake pedal to ensure that sufficient brake fluid is sucked in from the fluid reservoir during the return stroke of the plunger.
- The bleeding process is complete when clear, bubble-free brake fluid emerges via the bleeder hose.

Important!

The brake fluid pumped out during bleeding may not be reused since it may contain foreign matter which would then get back into the brake system.

- Fill fluid reservoir with brake fluid as far as "max" mark.



6. CHECKING THE BRAKE SYSTEM FOR LEAKS:

	<u>High-pressure test</u>	<u>Low-pressure test</u>
Line test pressure Gauge pressure	50 ... 100 bar	2 ... 5 bar
Test duration	10 minutes	5 minutes
Pressure drop of set value	10 % (max.)	0 %

Note

The leakage check, which must be performed in both brake circuits, comprises high-pressure and low-pressure testing.

A13

Leak check

Porsche 928 S



6.1 High-pressure test

- Connect pressure tester to fixed caliper. To do this, unscrew bleeder screw and screw in fitting. Then bleed pressure tester.
- Allow engine to run at medium speed and generate as high a vacuum as possible by suddenly releasing the accelerator pedal.
- Using the brake-pedal actuating device depress the brake pedal until a line pressure of between 50 and 100 bar gauge pressure is generated, then secure brake pedal in this position.
- During the test period of 10 minutes, the pressure drop may not be greater than 10% of the set value. If the pressure drop is greater than this figure the leak must be sought and eliminated, or the hydraulic modulator must be replaced.

6.2 Low-pressure test

- Release brake pedal actuating device until a line pressure of 2...5 bar gauge pressure is indicated on the pressure gauge.
- During a test period of 5 minutes the set pressure may not drop. If a drop in pressure is detected, the leak must be sought and eliminated, and the brake master cylinder or the hydraulic modulator must be replaced.



7. GENERAL NOTES ON REPAIR WORK AND BRAKE SYSTEM

The ABS is basically maintenance-free, but when performing work on ABS-equipped vehicles, pay attention to the following:

1. If welding work is to be performed with an electric welding unit, the electronic controller plug must be removed.
2. During painting work the electronic controller may be subjected to a maximum of 95°C for brief periods and a maximum of 85°C for lengthy periods (approx. 2 hours).
3. After replacement of the hydraulic modulator, controller, wheel-speed sensors and wiring harness as well as work involving the ABS assemblies (e.g. work performed after accidents), the entire ABS system must be checked using the tester. Make absolutely sure that the brake lines are laid correctly.
4. After any work on the brake system, the brake system must be bled and high-pressure as well as low-pressure testing performed. All junctions are to be checked for leaks.
5. If the battery has been removed, the cable clamps at the two terminals must be properly tightened after re-installation.
6. Do not use a fast charger for starting the engine.
7. Never disconnect the battery from the vehicle electrical system with the engine running.



8. Disconnect the battery from the vehicle electrical system when fast charging.

9. Make sure that all connectors of the wiring harness are securely connected.

10. Never connect or disconnect the wiring-harness plug of the controller with the ignition switched on.

11. For safety reasons, the hydraulic modulator must not be repaired, but the complete unit must be replaced.

Exceptions to this are the return-pump relay and the valve relay. Both relays may be replaced.

No screws on the hydraulic modulator may be loosened apart from the brake-line connections. After loosening it is no longer possible to get the brake circuits leak-tight! Danger!



8. FUNKTION AND CHECKING OF ABS INDICATOR LAMP.

Vehicles equipped with ABS come into the workshop with one of the following customer complaints:

- Indicator lamp not lighting up after switching on the ignition.
- Indicator lamp not going out after reaching idle speed.
- Indicator lamp lighting up again when driving or lighting up occasionally.

Confirm the complaint yourself before checking the entire ABS system with the ABS tester. For reasons of safety, the ABS may only be checked using the ABS tester. The ignition must always be off for connecting the ABS tester as well as when connecting or disconnecting the controller. If you have detected a fault with the ABS tester, always disconnect the controller before performing further trouble-shooting.

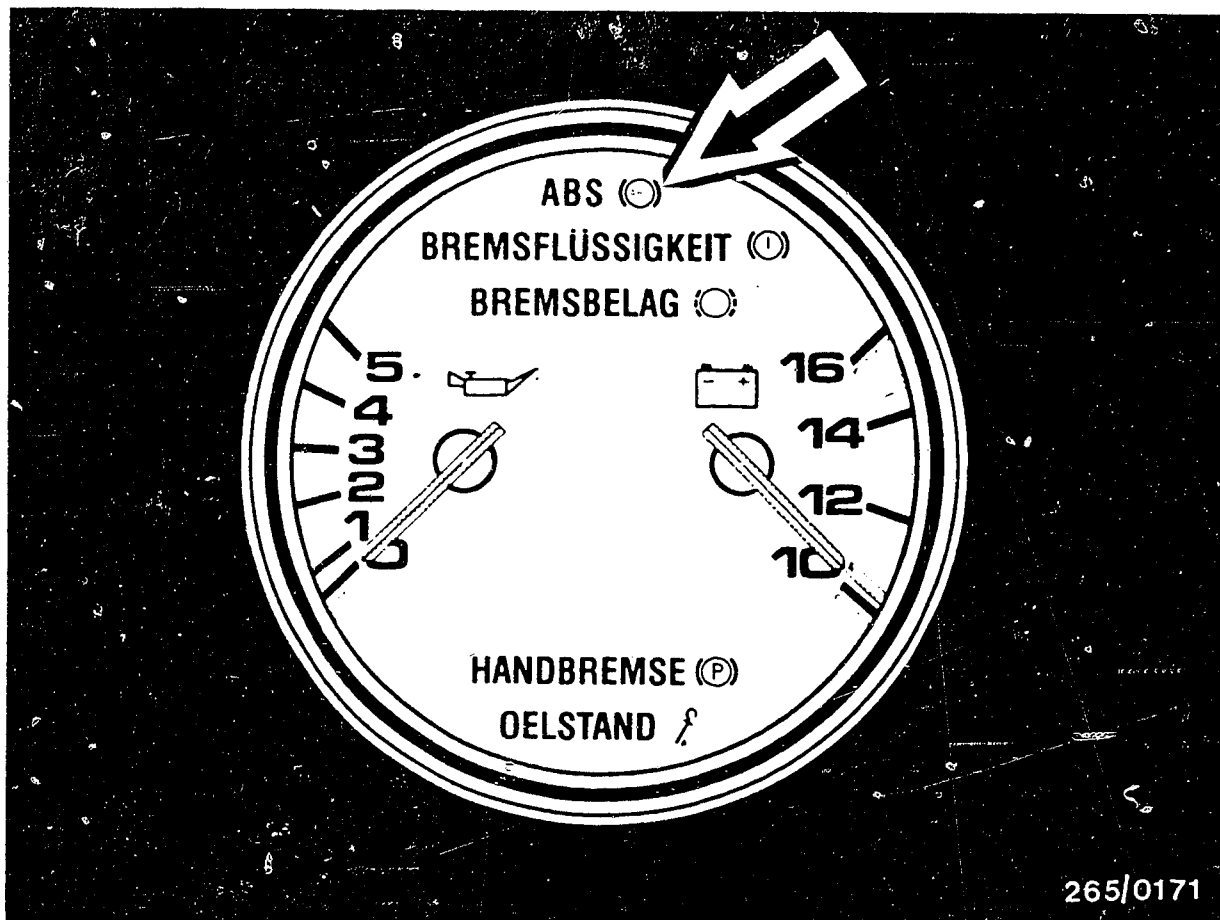
In the following you are informed of the correct function and malfunction of the ABS indicator lamp.

B1

Test ABS indicator lamp

Porsche 928 S





Arrow = ABS indicator lamp in instrument cluster

8.1 ABS indicator lamp

When the ignition is switched on the indicator lamp identified by the letters "ABS" lights up. After the engine has started and the idle speed has been reached the ABS indicator lamp goes out (terminal 61 of alternator supplies voltage to ABS controller).

When the vehicle exceeds a speed of approx. 6 km/h with all 4 wheels for the first time after starting, the ABS system performs a self-check (BITE sequence).

This process is repeated each time the ignition is switched off and the engine is started again.

In addition, the ABS constantly checks itself to a certain extent while driving.

B2

Check ABS indicator lamp

Porsche 928 S



Incorrect indicator lamp indications are:

- Indicator lamp not lighting up after switching on the ignition.
- Indicator lamp not going out after reaching a idle speed.
- Indicator lamp lights up again while driving or lights up occasionally.

The lighting up of the ABS indicator lamp tells the driver that the ABS is not in working order. Nevertheless, the conventional brake system is still available. However, locking of the wheels is possible.

General note

Occasional lighting up of the indicator lamp may be caused by an insufficiently charged battery. The lamp only lights up as long as there is undervoltage, e.g. after switching on loads at idle.

The causes of trouble are to be established with the aid of the ABS tester and a dynamic brake analyzer.



9. ABS TESTER

The tester checks functions of the controller, of the hydraulic modulator, of the wiring harness and also checks the components of the antiskid system (ABS).

The ABS tester measures actual values which are compared with the respective nominal values.

If the actual value indicated differs from the nominal value, carry out trouble-shooting as directed in the "trouble-shooting" column.

Connect the ABS tester between the controller and the ABS wiring harness (switch off the ignition to connect the tester).

On the Audi (4-channel ABS) it is necessary to use the adapter cable for the controller owing to the different mechanical coding.

Do not drive the vehicle with the tester connected.

The respective test steps are set with the program-selector switch (1 to 24).

For the wheel-speed sensors and the hydraulic modulator depress the round buttons according to the test chart.

Test steps with a high power requirement are not triggered until after the illuminated key has been pressed.

The illuminated key lights up automatically in the respective test steps.

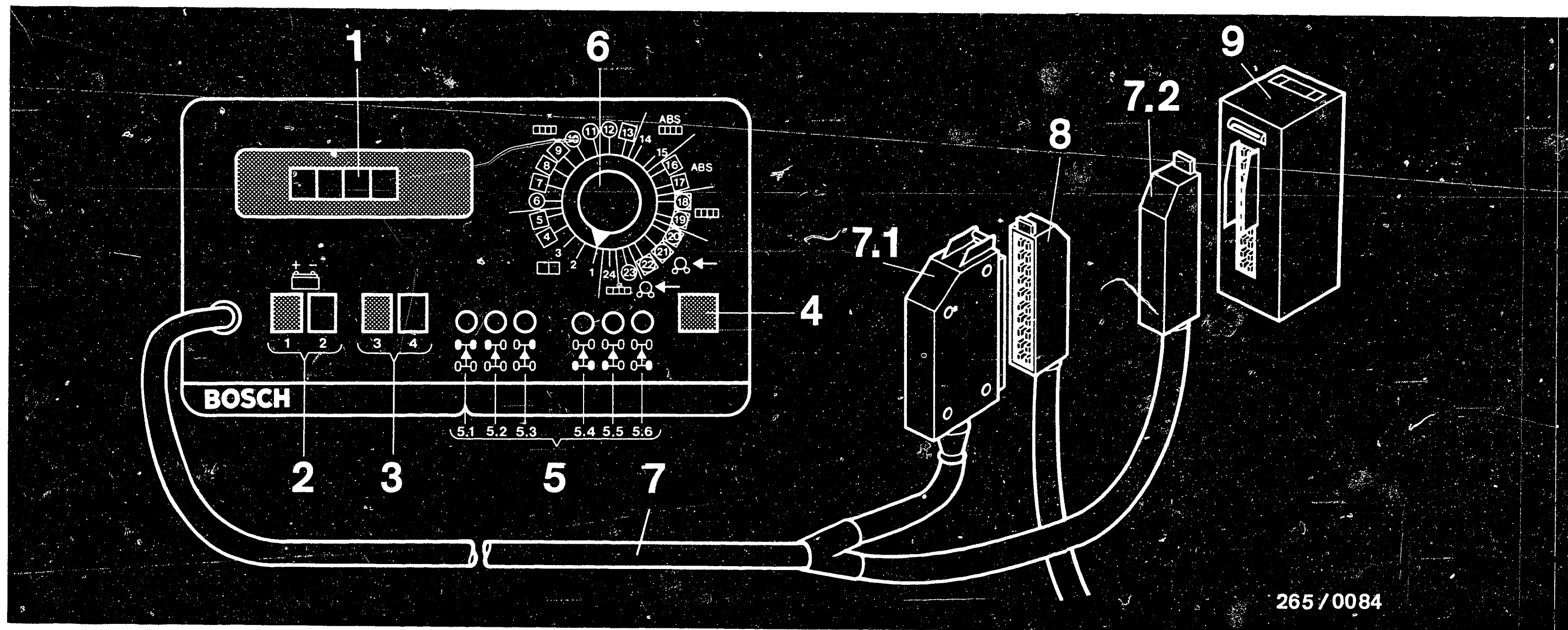
The actual value is indicated either by the green-red-lamps or by the digital display.

The test steps with the program-selector switch in positions 20...23 can only be performed on a dynamic brake analyzer.

For generations 2B it is absolutely necessary that the tester has been converted to meet the latest requirements.

Note designation "U2" on nameplate.





ABS-tester

- 1 = Digital LED display unit
- 2 = Lamp 1 (green): battery voltage O.K.
- = Lamp 2 (red): battery voltage too low
- 3 = Lamp 3 (green): return-pump relay and valve relay as well as overvoltage protection O.K.
- = Lamp 4 (red): return-pump relay and valve relay as well as overvoltage protection defective
- 4 = Illuminated key, yellow, for triggering individual test steps
- 5 = Channel selection key (wheel selection)
- 5.1 = Front axle (FA)
- 5.2 = Front left wheel (FL)
- 5.3 = Front right wheel (FR)

- 5.4 = Rear axle (RA)
- 5.5 = Rear left wheel (RL)
- 5.6 = Rear right wheel (RR)
- 6 = Program-selector switch
- 7 = Connecting cable
- 7.1 = Connection to wiring harness
- 7.2 = Connection to controller
- 8 = Multiple plug of vehicle wiring harness
- 9 = ABS controller (installed in vehicle)

B5

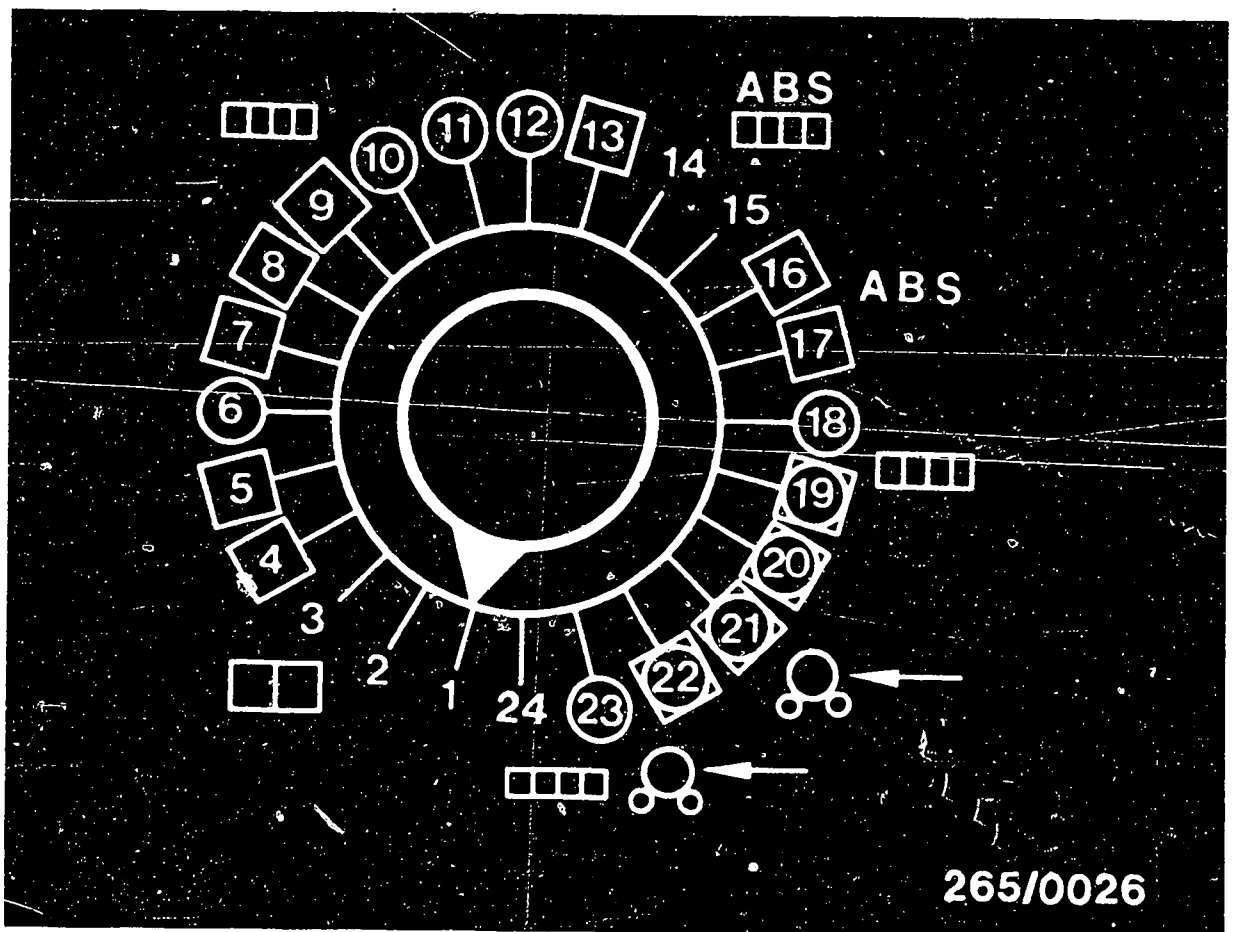
ABS tester
Porsche 928 S



B6

ABS tester
Porsche 928 S





Program-selector switch (description of symbols)

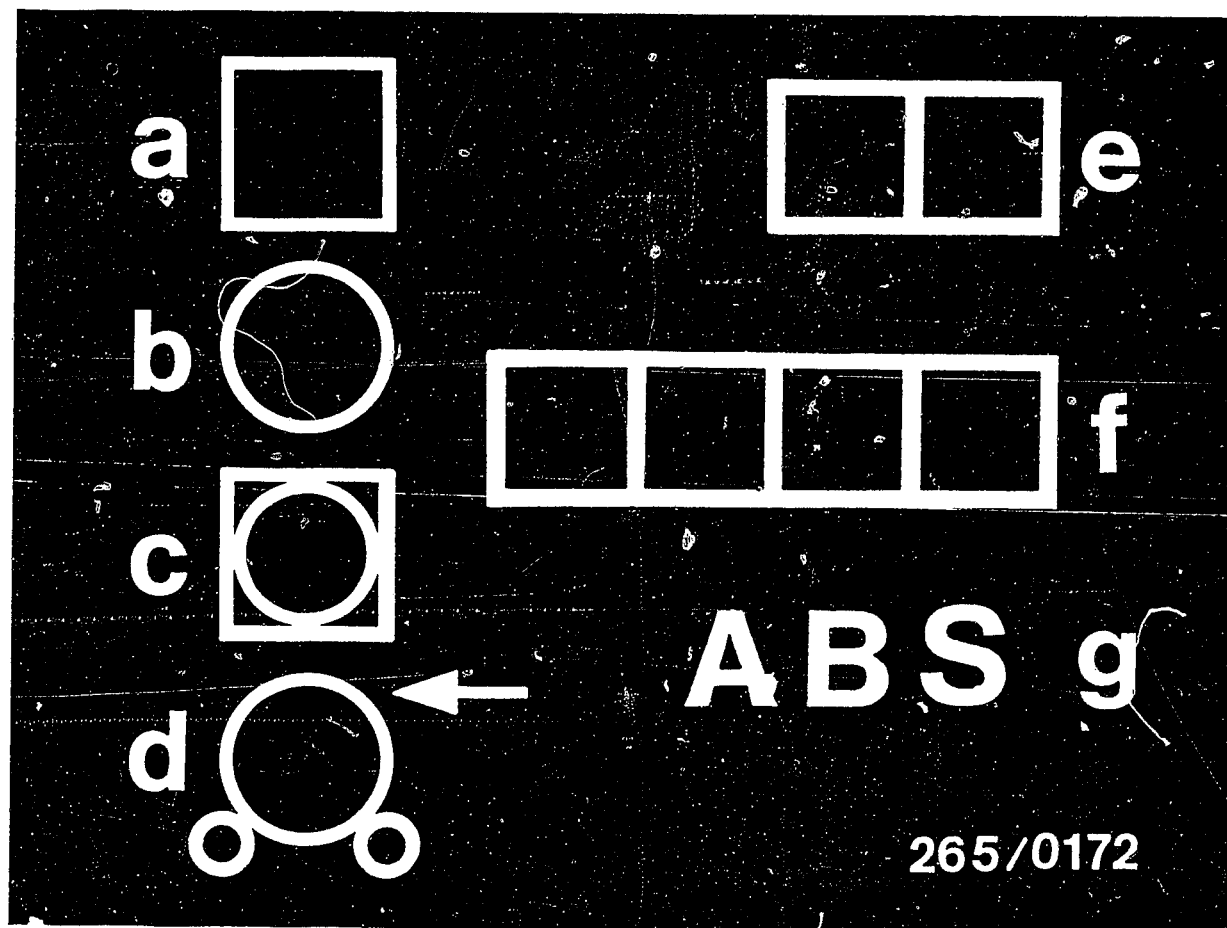
Program-selector switch for 24 program steps

B7

ABS tester

Porsche 928 S





265/0172

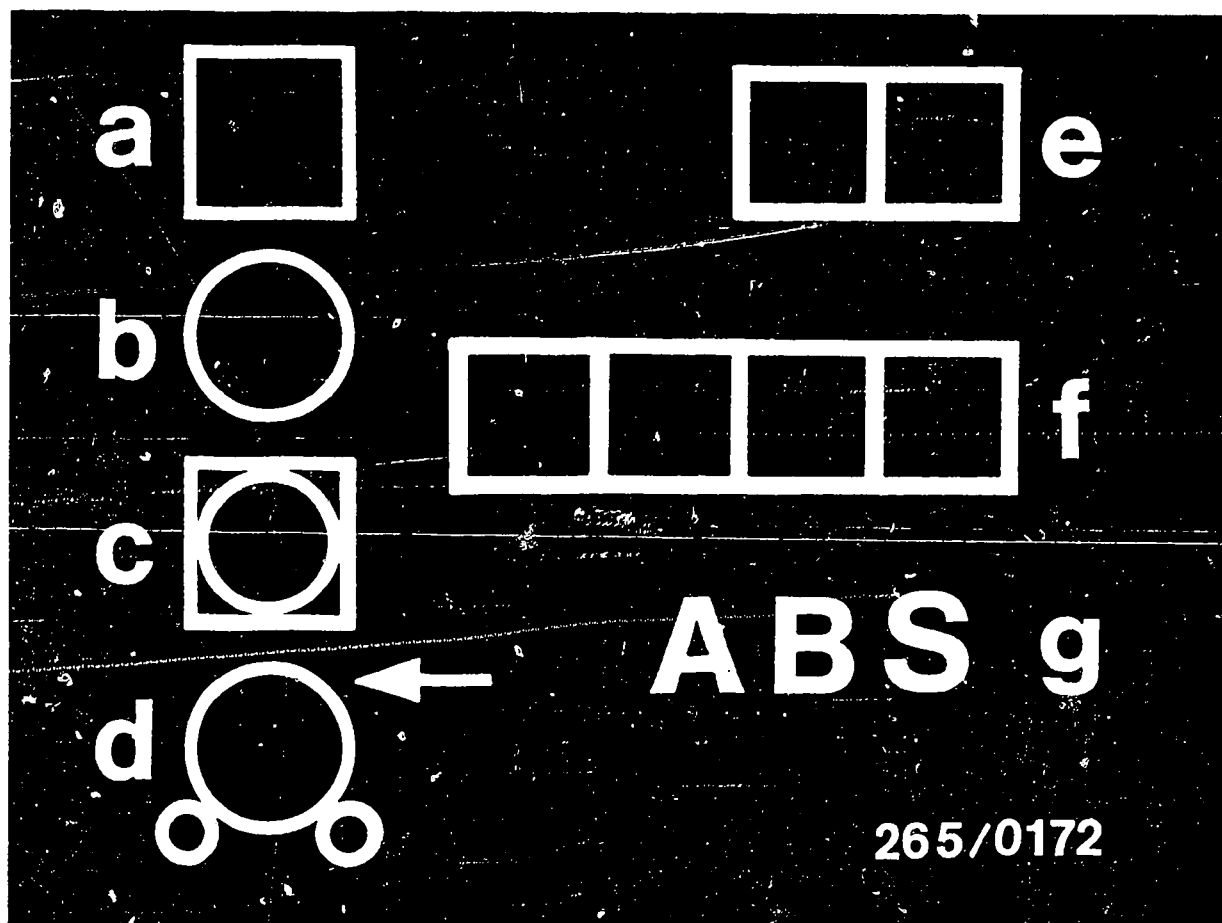
Symbols for additional operation:

- a = Press illuminated key (Item 4)
- b = Press respective keys for channel selection (Items 5.1 to 5.6)
- c = Press key for channel selection (Items 5.1 to 5.6). Press illuminated key (Item 4).
- d = Drive front and rear axles of vehicle one after the other onto brake analyzer.

B8

ABS tester
Porsche 928 S





e = Red-green indicator, lamp units (Items 2 and 3)

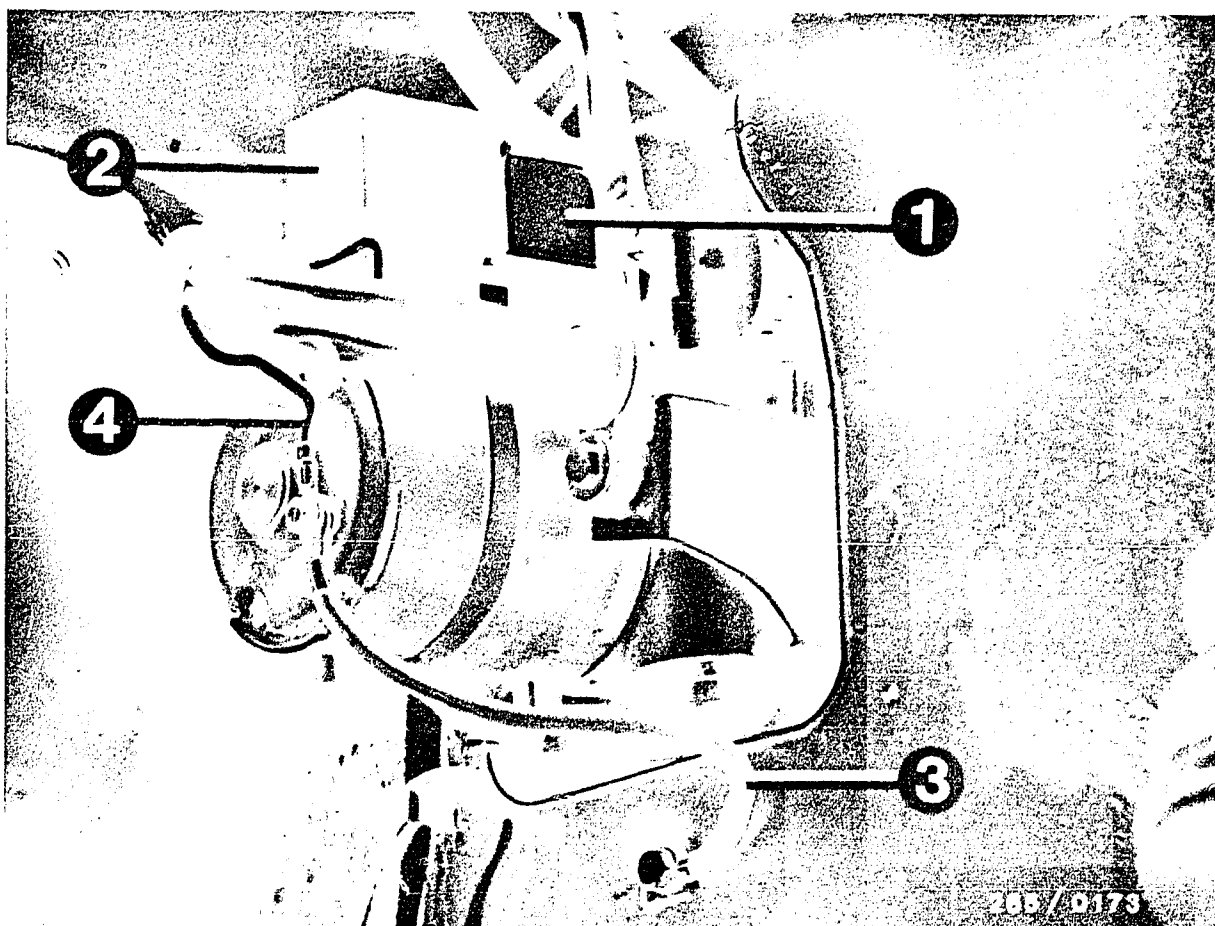
f = Digital display unit (Item 1)

g = Watch indicator lamp in vehicle.

B9

ABS tester
Porsche 928 S





- 3 = Ground connection of return pump
4 = Ground connection of valve relay

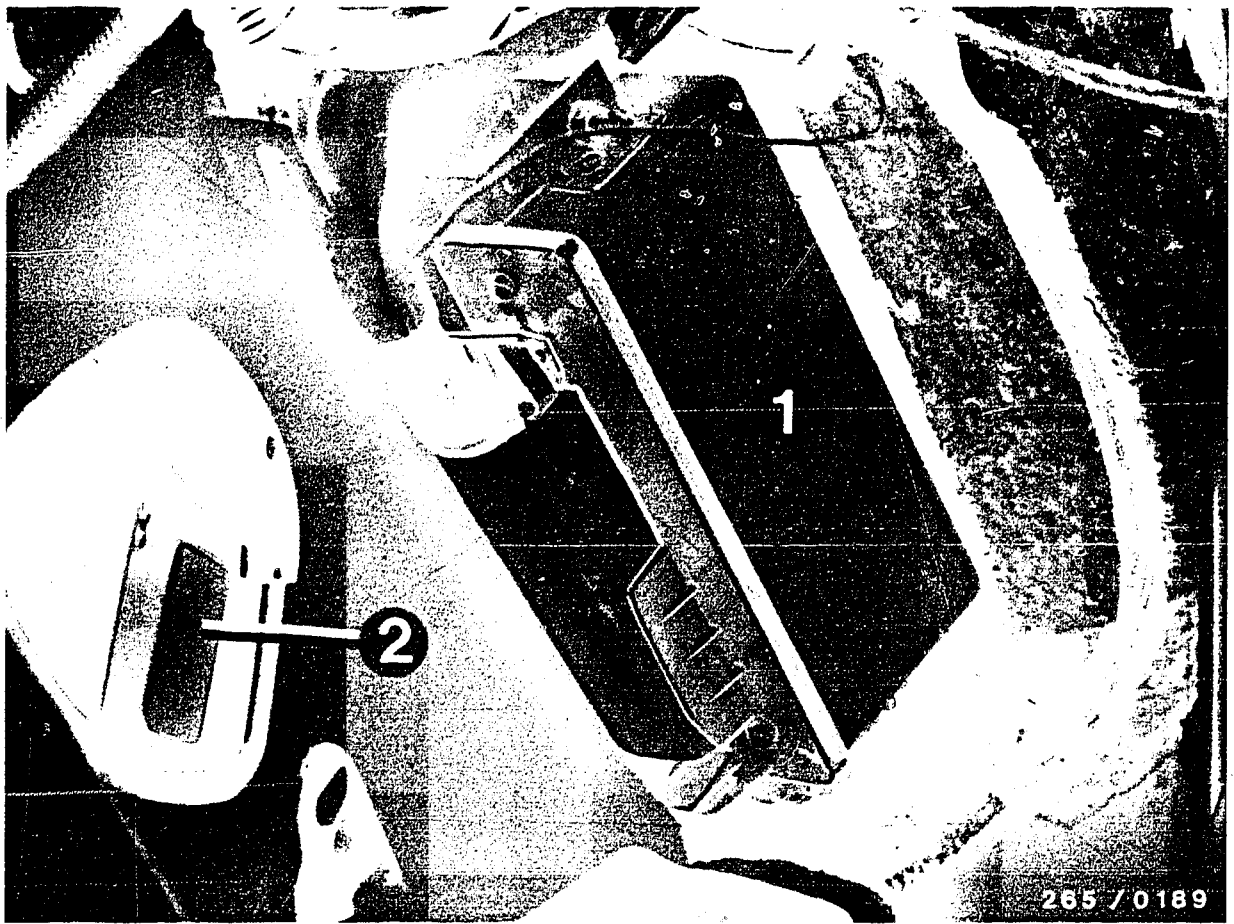
10. TEST CONDITIONS FOR TESTING WITH ABS TESTER

- Test ground connection of return pump and ground connection of valve relay for security.
- Test hydraulic connections on hydraulic modulator and joints for leaks (visual examination).



- If the ABS indicator lamp lights up occasionally when driving (e.g. after switching on loads) and goes out again automatically, check the battery and the power supply (generator, regulator and voltage drops).
- If the ABS indicator lamp lights up constantly and does not go out, check the following points:
 - Is the multiple plug correctly fitted to the controller and has it locked in position?
Are all plug contacts O.K.?
Have the spring contacts locked in position?
 - Has the V-belt broken? (generator not providing any power, charge indicator lamp and ABS indicator lamp light up).
 - Is there voltage at generator terminal 61?
Plug connector and cable to ABS controller O.K.?
 - Pay particular attention to testing for loose contacts on wheel-speed sensors with program-selector switch in position 10.





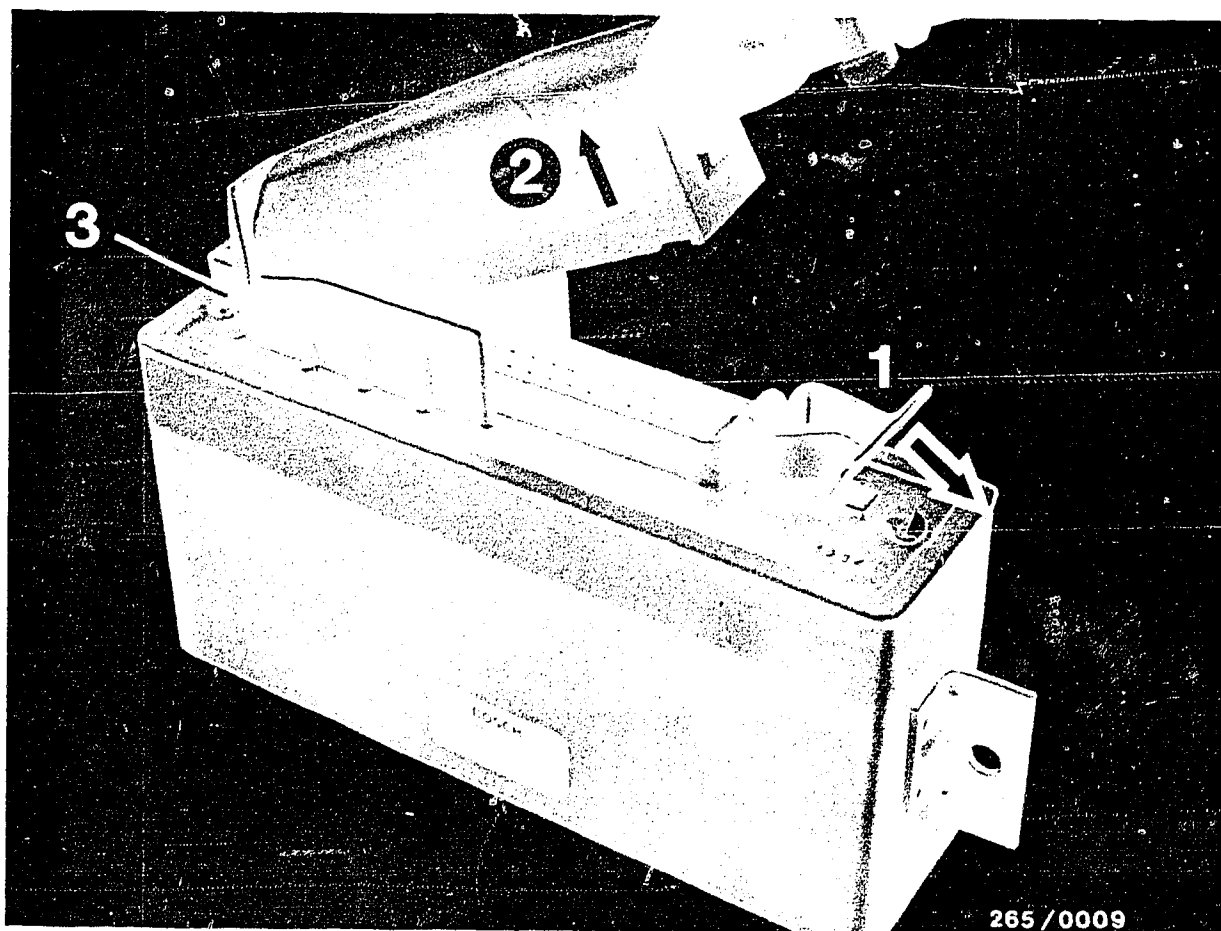
1 = ABS controller
2 = Lid release handle

- Connect ABS tester to controller and ABS wiring harness.

Caution

Connect and disconnect controller only with ignition off.

The controller is installed in the driver's footwell on the left above the lid release handle. To remove the controller, loosen fastening nuts and take out controller.



- 1 = Spring
- 2 = Multiple plug (35-pin)
- 3 = Encoding block

Switch off ignition before disconnecting multiple plug.

Press back spring, hinge up multiple plug and unhook from encoding block.

- For testing with the tester, switch on the ignition in all program-selector switch positions (tester operates on power supply from vehicle battery)
- Watch tester lamps 1 and 2 in all program-selector switch positions.

Caution!

Do not drive the vehicle with the tester connected!

Repeat the entire test program after any repairs.

General note on trouble-shooting

Check all cables for short circuit to ground and for contact with positive cables, and watch for any indications of wear, abrasion and pinching.



11. TESTING WITH THE ABS-TESTER

Note on test steps 1 ... 43

In the following test steps a broad, white surrounding frame in the "Operation" column indicates which operation has to be changed compared with the preceding test step.

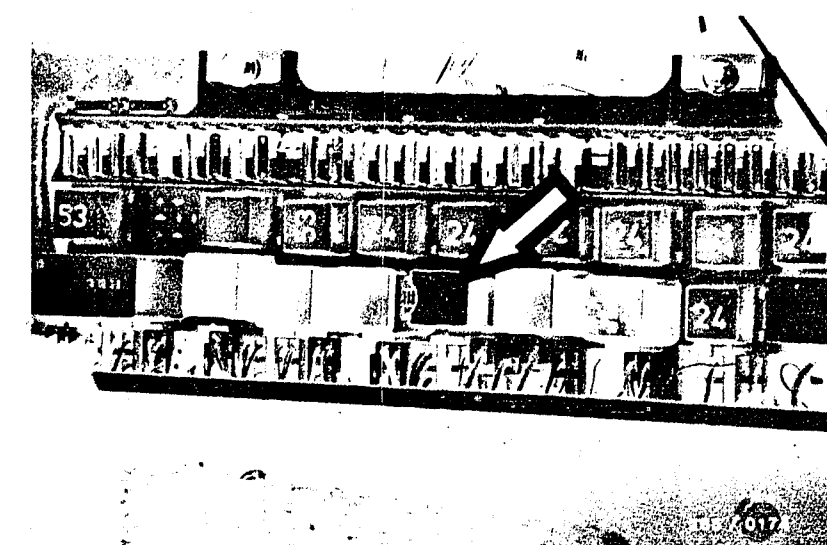
B15

Test with ABS tester

Porsche 928 S



TEST STEP 1 Note: This test step is important for all the following test steps, i.e. watch lamps 1 and 2 throughout the entire test procedure.



Arrow = Overvoltage protection relay

<u>Operation:</u>		<u>Reading:</u>	<u>Testing:</u>
Program-selector switch position	1 to 24	Lamp 1 (green) must light up	Component: Power supply
<u>Operation in vehicle:</u> Switch on ignition		<u>Note:</u> Lamp 1 (green) = O.K. Lamp 2 (red) = fault. Watch for occasional lighting up. If reading O.K., continue testing with next test step.	<u>Operation:</u> Monitoring of power supply in all program-selector switch positions. <u>Malfunction:</u> 1. No reading. 2. Green lamp goes out and red lamp lights up, possibly only briefly as long as there is undervoltage

Trouble-shooting (switch off ignition):

1. No reading:

- Multiple plug incorrectly connected.
- Plug-in fuse in overvoltage protection relay defective.
- Overvoltage protection relay defective - replace.

Check the following leads:

- Positive lead from B+ to overvoltage protection relay term. 30.
- Negative lead from overvoltage protection relay term. 31 to ground in central-electrics console.

Continued on B18/B19

B16

Test with ABS tester

Porsche 928 S



B17

Test with ABS tester

Porsche 928 S



Trouble-shooting for TEST STEP 1 (continued)

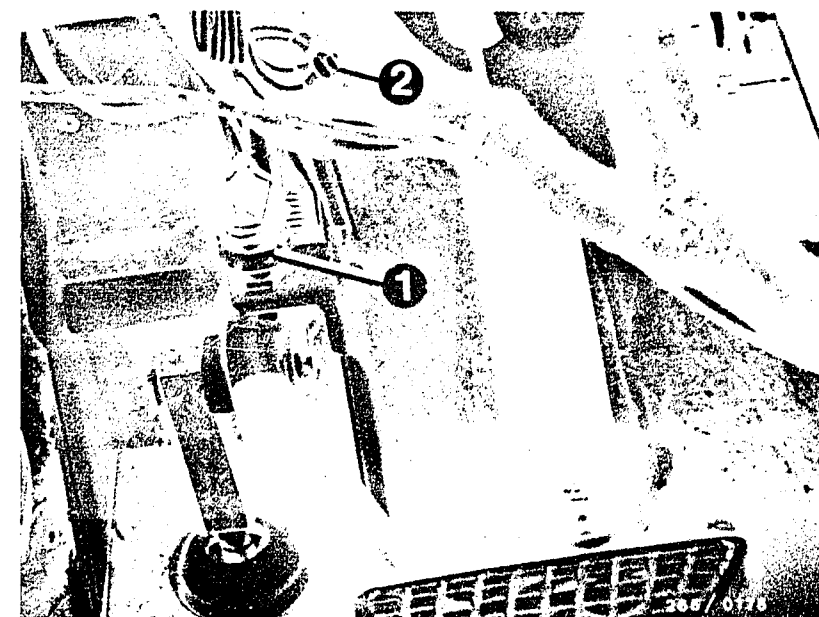
- Negative lead from ground terminal on steering bracket to multiple plug term. 10.
- ABS ground terminal must be bare down to the metal and must not have any contact resistance.
- Positive lead from overvoltage protection relay term. 87 to multiple plug term. 1 through Y-connector term. 1 in central-electrics console.
- Positive lead from overvoltage protection relay term. 15 to driving switch term. 15.

Lamp 2 (red) lights up or lights up occasionally during testing:
Stop test and eliminate cause of trouble.

Causes of trouble:

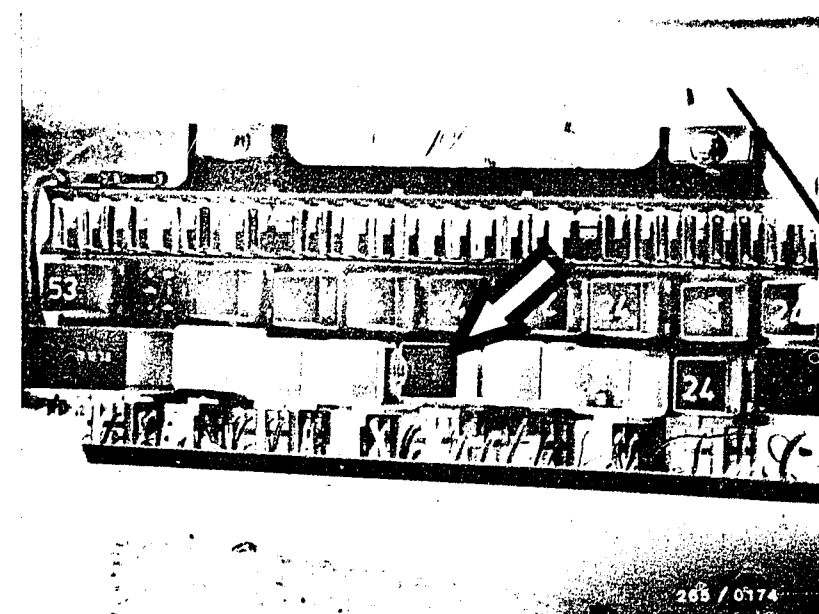
1. Battery insufficiently charged. Charge battery or let engine run.
2. High voltage drops across ABS ground terminals. Ground terminals must be bare down to the metal.

After remedying fault, perform complete test program



- 1 = Stop-lamp
2 = ABS ground terminal on steering bracket

Arrow = Overvoltage protection relay



B 18

Test with ABS tester

Porsche 928 S



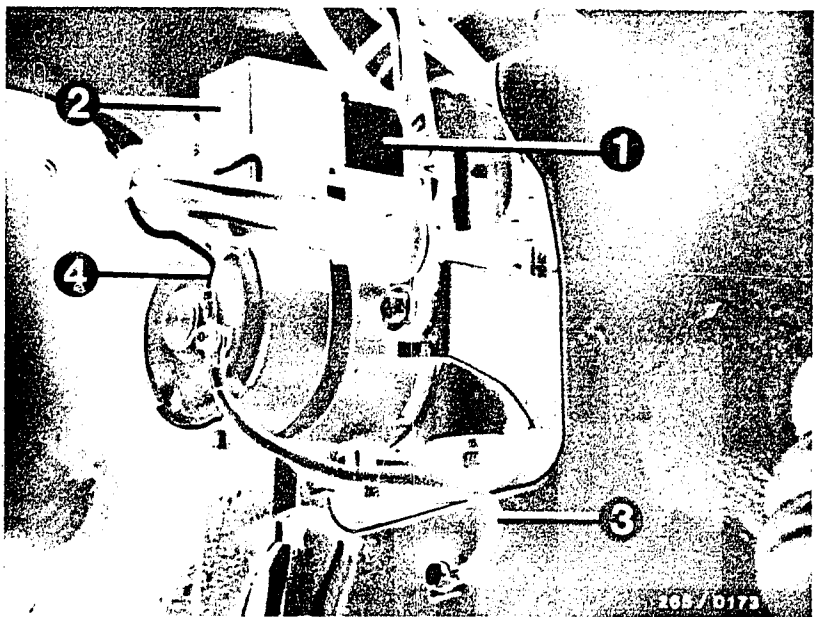
B 19

Test with ABS tester

Porsche 928 S



TEST STEP 2			
Operation:		Reading:	Testing:
Program-selector switch position	1	Lamp 3 (green) must light up	Component: Valve relay
Operation in vehicle: Switch on ignition		If reading O.K., continue testing with next test step.	Operation: Off-position
			Malfunction: Lamp 4 (red) lights up



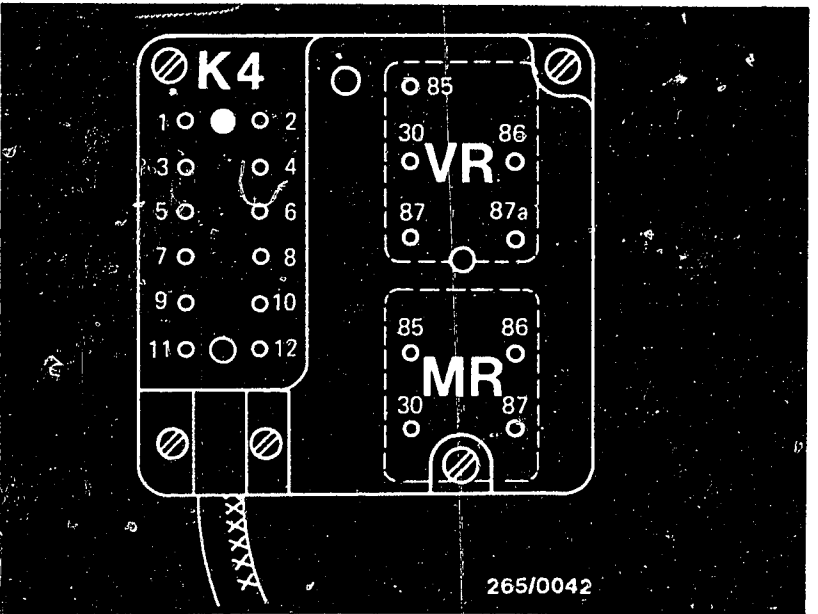
- 1 = Valve relay
- 2 = Motor relay
- 3 = Ground connection of return pump
- 4 = Ground connection of valve relay

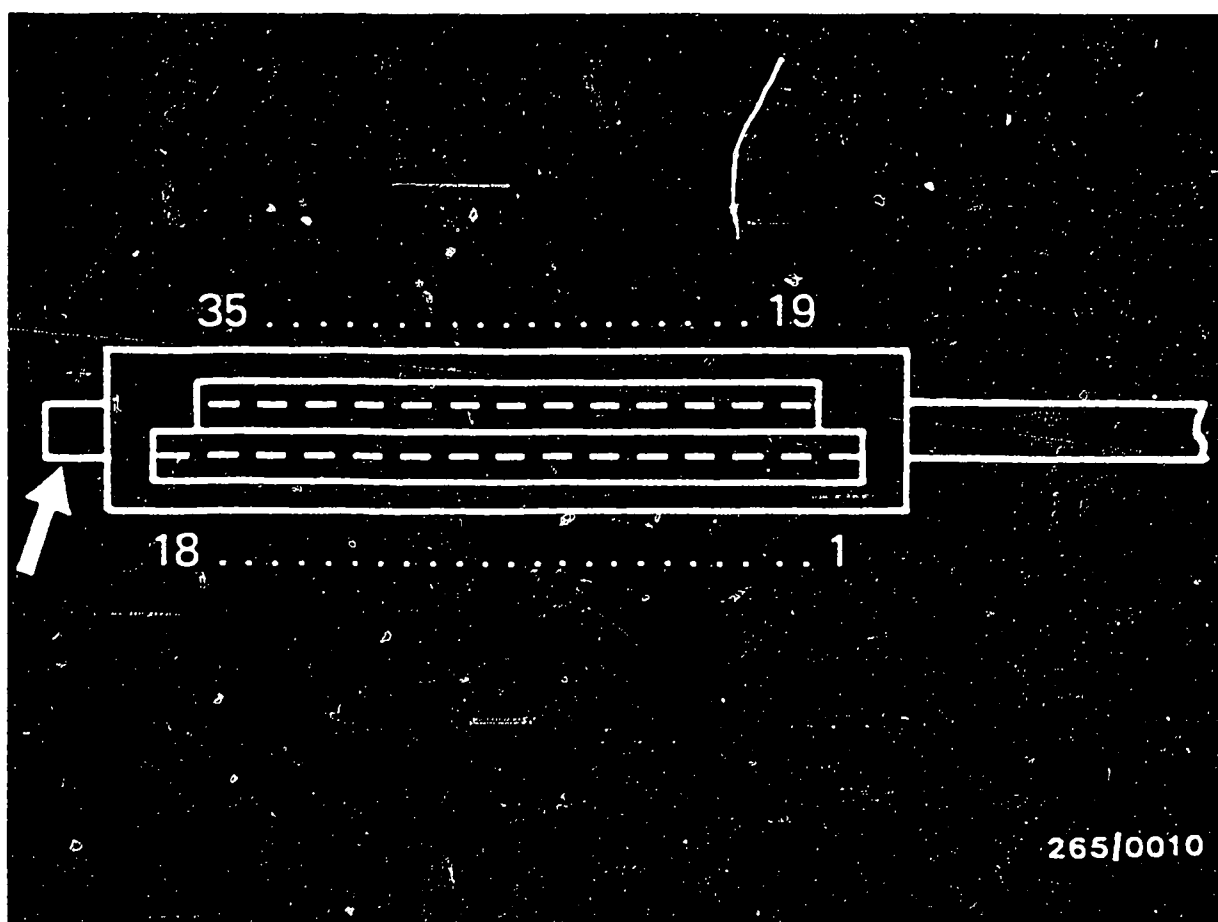
Top view of plug-in plate of hydraulic modulator
 VR = Valve relay
 MR = Return-pump relay
 K4 = Wiring harness plug

Trouble-shooting (switch off ignition):

- Valve relay defective.
 Caution! Use only relay with correct electrical terminal assignment.
- Ground connection has high contact resistance or open circuit.
- Test the following cables for continuity:
 - From ground to plug K 3/term. 8.
 - From K 4/term. 8 to valve relay term. 87a.
 - From K 4/term. 4 to valve-relay plug term. 30.
 - From K 3/term. 4 to multiple plug K 1/term. 32.

Continued on B 22





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Trouble-shooting for TEST STEP 2 (continued)

Top view of multiple plug K 1 (35-pin) with terminal numbers.

Arrow = Lug with mechanical coding

B22



Test with ABS tester
Porsche 928 S

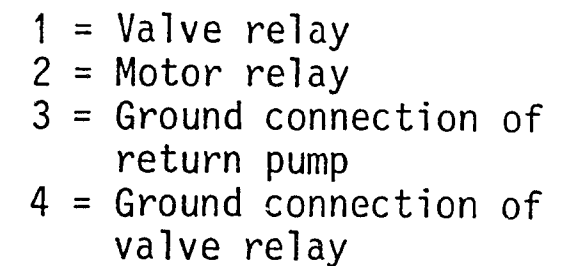


<u>TEST STEP 3</u>		<u>Reading:</u>	<u>Testing:</u>
<u>Operation:</u>			
Program-selector switch position	1	Lamp 3 (green) must light up	<u>Component:</u> Valve relay
<u>Operation in vehicle:</u>			<u>Operation:</u> Relay make contact
Switch on ignition		If reading O.K., continue testing with <u>next test step.</u>	<u>Malfunction:</u> Lamp 4 (red) lights up

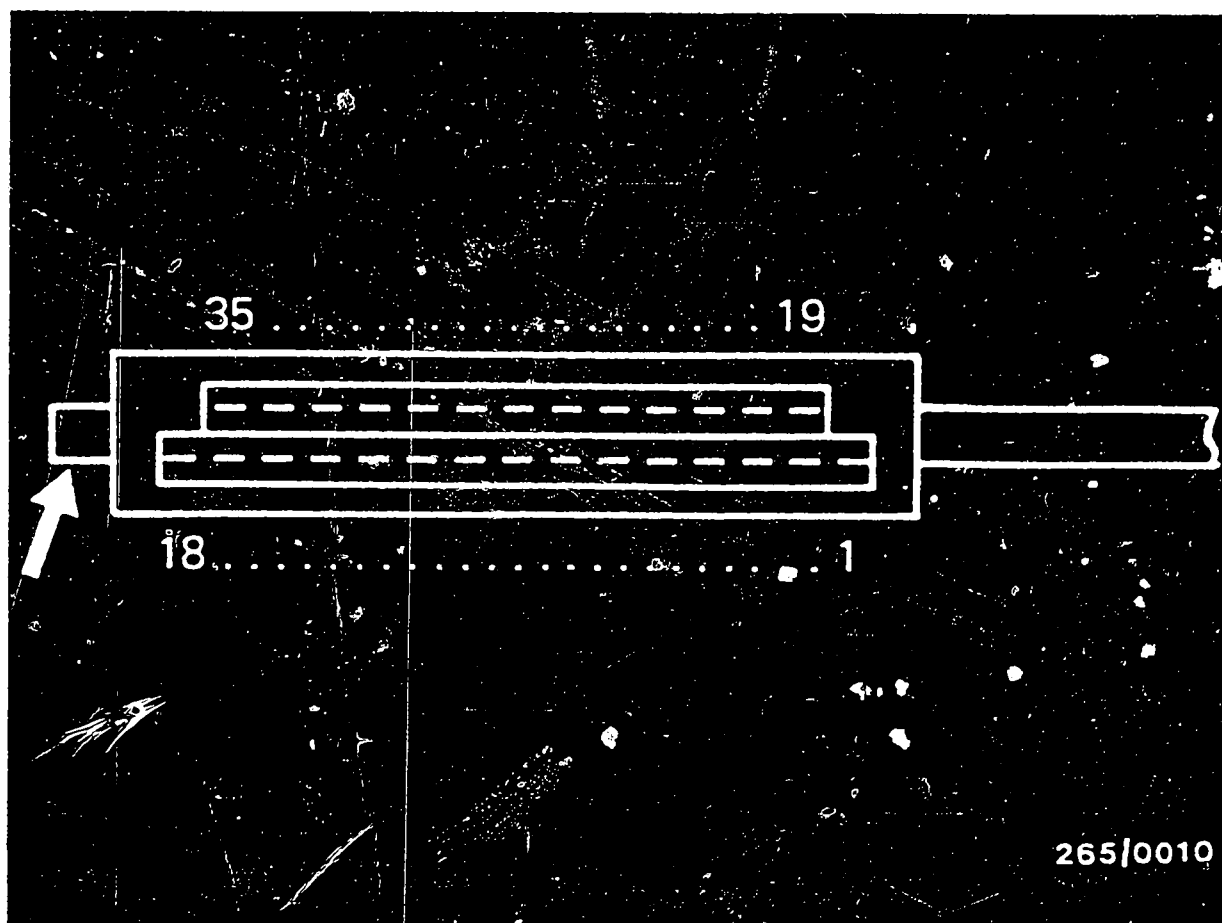
- Valve relay defective.
Caution! Use only relay with correct electrical terminal assignment.

- From term. B+ to plug K3/term.6
From K4/term.6 to valve relay term.87
From K3/term.2 to multiple plug K1/term.27
From K4/term.2 to valve relay term.85
From valve relay term.86 to return-pump relay term.86
From return-pump relay term.86 to K4/term.10
From K3/term.10 to overvoltage protection relay term.87 through Y-connector
term. 1 in central-electrics console.

B 23	Test with ABS tester Porsche 928 S	 
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Technical drawing of a control panel, labeled K4. The panel features a grid of 12 circular indicators (1-12) and two modules labeled MR. The MR modules contain indicators 85, 86, 87, and 87a. The panel is secured by four screws (top-left, top-right, bottom-left, bottom-right) and has a cable with a braid (XXXX) extending from the bottom.



265/0010

Trouble-shooting for TEST STEP 3 (continued)

Top view of multiple plug K 1 (35-pin) with terminal numbers.

Arrow = Lug with mechanical coding.

C1

Test with ABS tester

Porsche 928 S



TEST STEP 4

Operation:

Program-selector switch
position

3

Reading:

Lamp 3 (green)
must light up

Testing:

Component:

Return-pump relay

Operation in vehicle:

Switch on ignition

Operation:

Off-position

If reading O.K., continue testing with next test step.

Malfunction:

Lamp 4 (red) lights up

Trouble-shooting (switch off ignition):

- Return-pump relay defective.
- Check ground terminals of pump motor for security and contact resistance.
- Test the following cables for continuity:
From multiple plug K1/term. 14 to plug K 3/term. 9.
From K 4/term. 9 to return-pump relay term. 30 and to positive terminal of pump motor.
- Check positive terminal of pump motor for security.
Check pump motor for continuity. If no continuity, continue testing with test step 5.

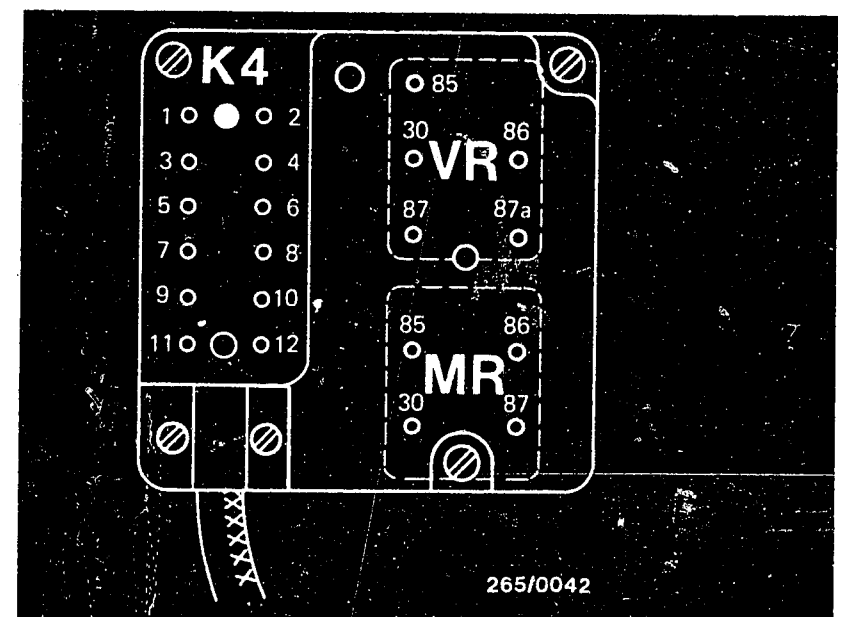
- 1 = Valve relay
- 2 = Motor relay
- 3 = Ground connection of return pump
- 4 = Ground connection of valve relay

Top view of plug-in plate of hydraulic modulator

VR = Valve relay

MR = Return-pump relay

K4 = Wiring harness plug



Continued on C 4

C2

Test with ABS tester

Porsche 928 S

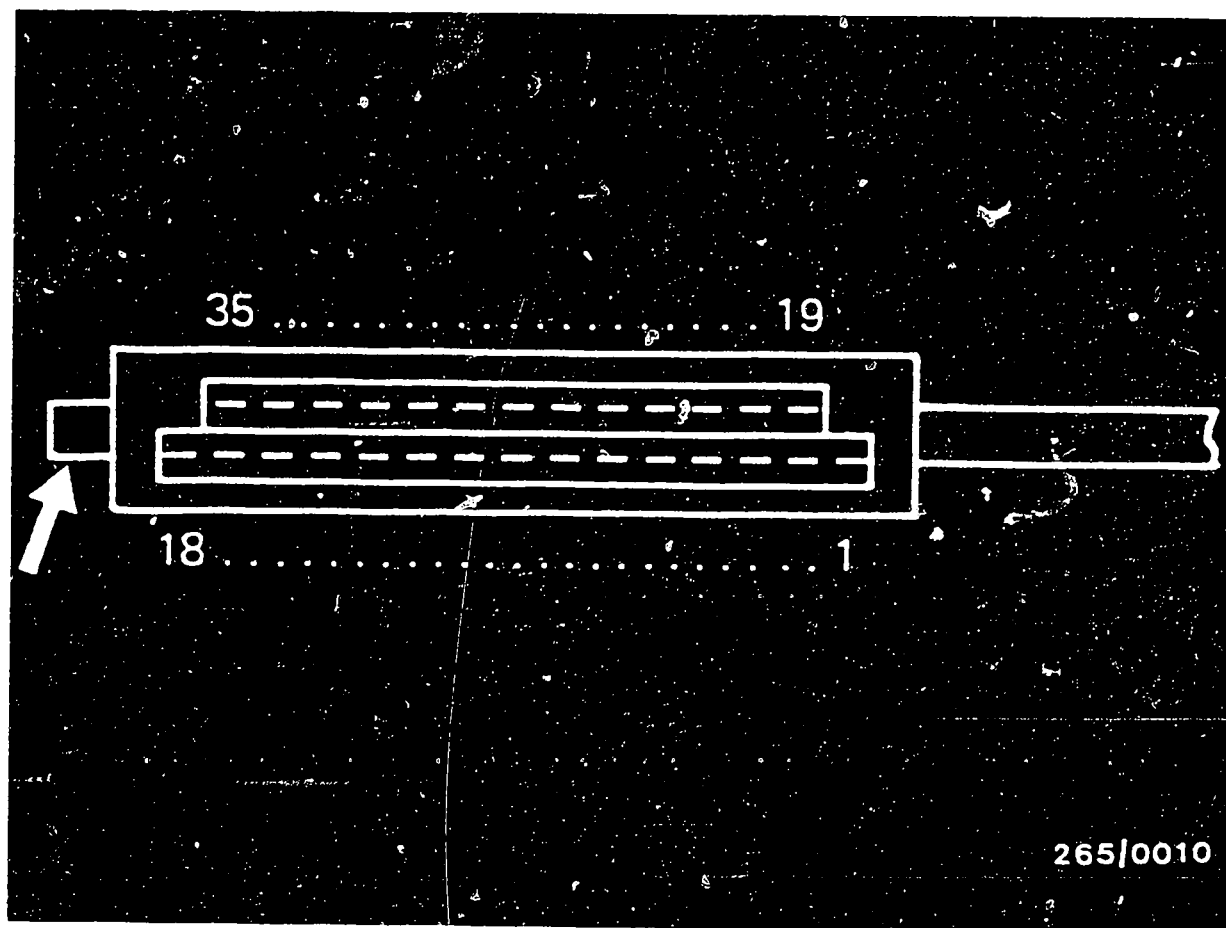


C3

Test with ABS tester

Porsche 928 S





Trouble-shooting for TEST STEP 4 (continued)

Top view of multiple plug K 1 (35-pin) with terminal numbers.

Arrow = Lug with mechanical coding

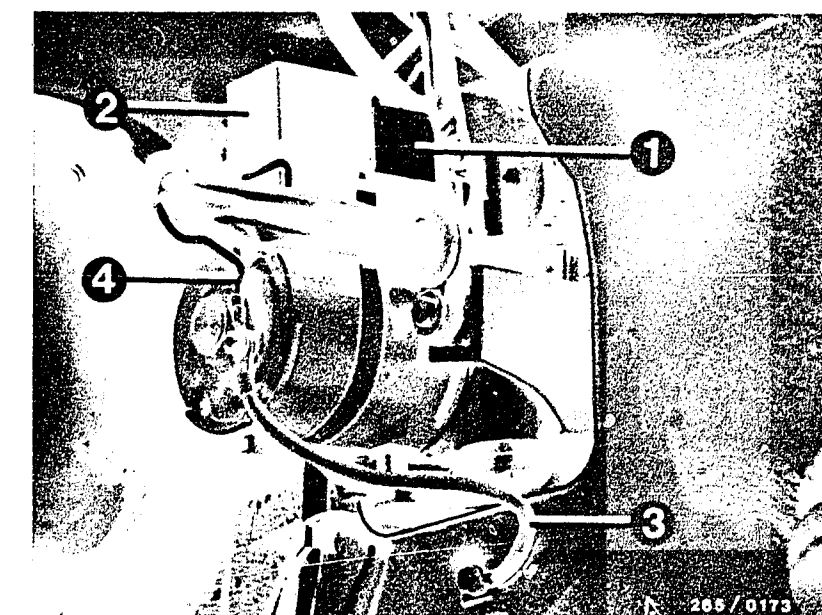
C4

Test with ABS tester

Porsche 928 S



TEST STEP 5			
Operation:		Reading:	Testing:
Program-selector switch position	4	Lamp 3 (green) must light up Pump motor can be heard to operate.	Component: Return-pump relay
Illuminated key lights up press key	●		Operation: Relay make contact
Operation in vehicle: Switch on ignition		If reading O.K., continue testing with next test step.	Malfunction: Lamp 4 (red) lights up



- 1 = Valve relay
- 2 = Motor relay
- 3 = Ground connection of return pump
- 4 = Ground connection of valve relay

Top view of plug-in plate of hydraulic modulator

VR = Valve relay

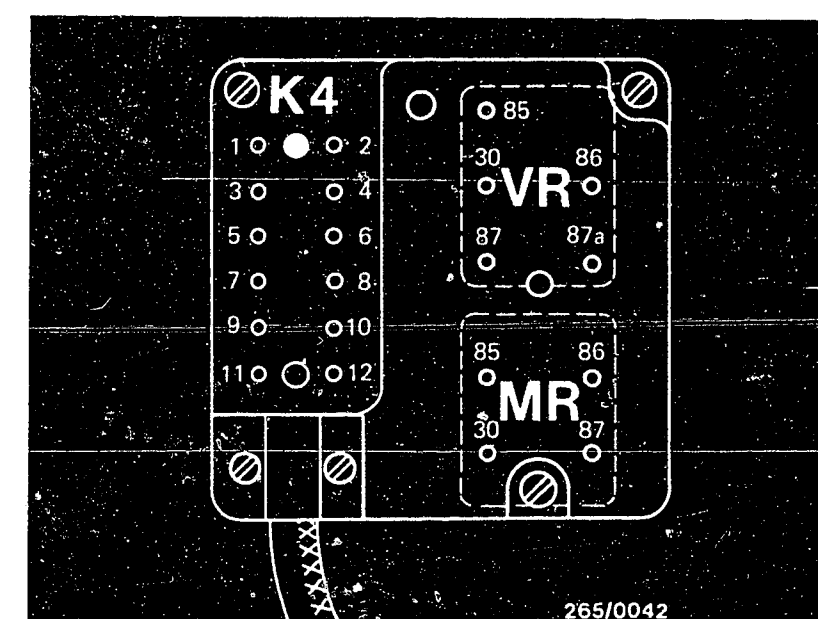
MR = Return-pump relay

K4 = Wiring harness plug

Trouble-shooting (switch off ignition)

- Return-pump relay defective.
- Test the following cables for continuity:
 - From multiple plug term.85 to K4/term.11
 - From K3/term.11 to multiple plug K1/term.28
 - From return-pump relay term.87 to K4/term.12
 - From K3/term.12 to term.B+
- Pump motor not operating:
 - Continue testing with test step 6.

Continued on C 7



C5

Test with ABS tester

Porsche 928 S

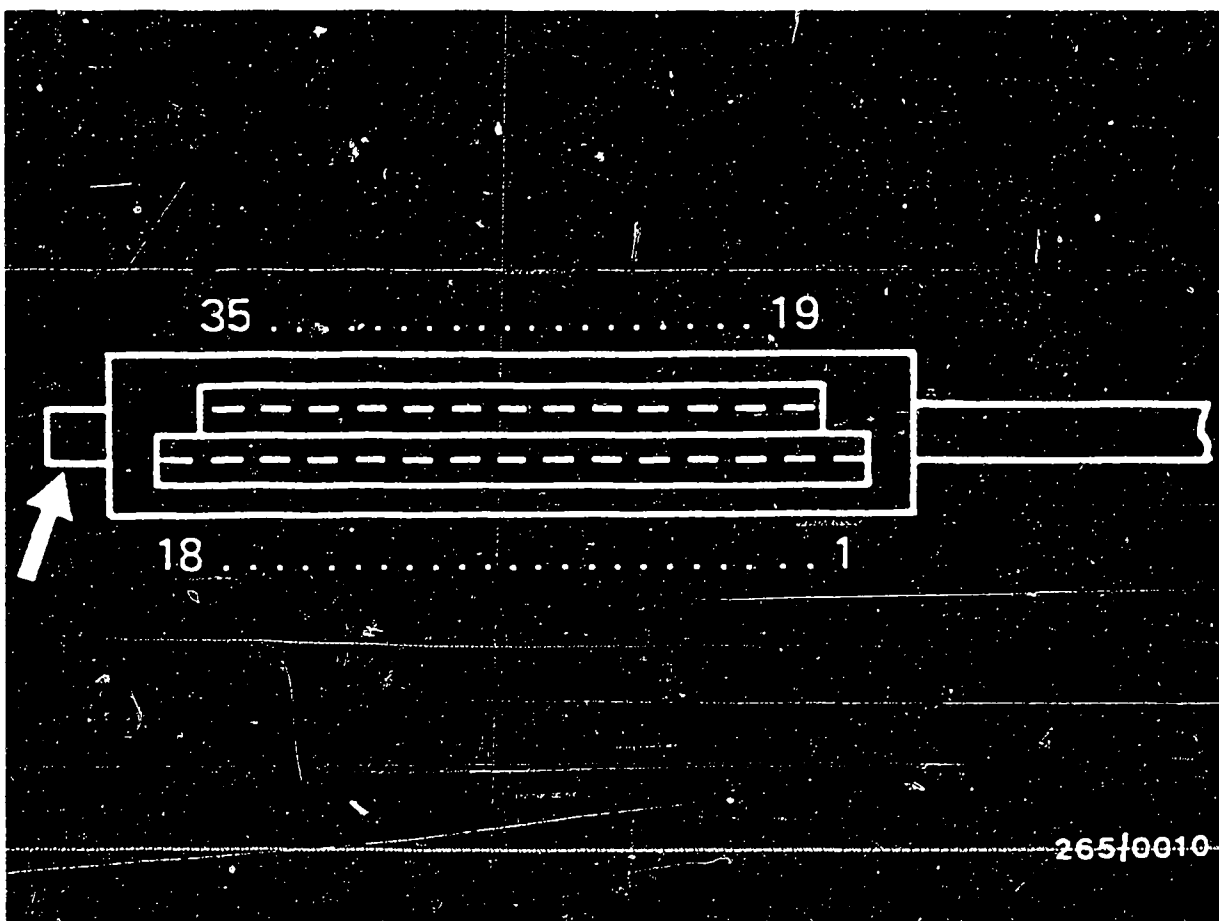


C6

Test with ABS tester

Porsche 928 S





Trouble-shooting for TEST STEP 5 (continued)

Top view of multiple plug K 1 (35-pin) with terminal numbers.

Arrow = Lug with mechanical coding.

TEST STEP 6

Operation:

Program-selector switch position

5

Additional operation:

1. Switch off ignition. Disconnect controller.

2. Using adapter cable, plug overvoltage protection relay from vehicle into test socket on back of tester.

Caution: Install only overvoltage protection relays of the same type. Plug adapter cable (as shown in bottom picture) in test socket turned through 180° and offset.

3. Plug new overvoltage protection relay in vehicle and leave there.

4. Switch on ignition and wait approx. 1 s, then press illuminated key (lit).

5. Reading O.K., overvoltage protection relay in test socket O.K.

6. Re-connect controller, switching off ignition beforehand.

Reading:

Lamp 3 (green) must light up.

If reading O.K. continue testing with next test step.

Testing:

Component:

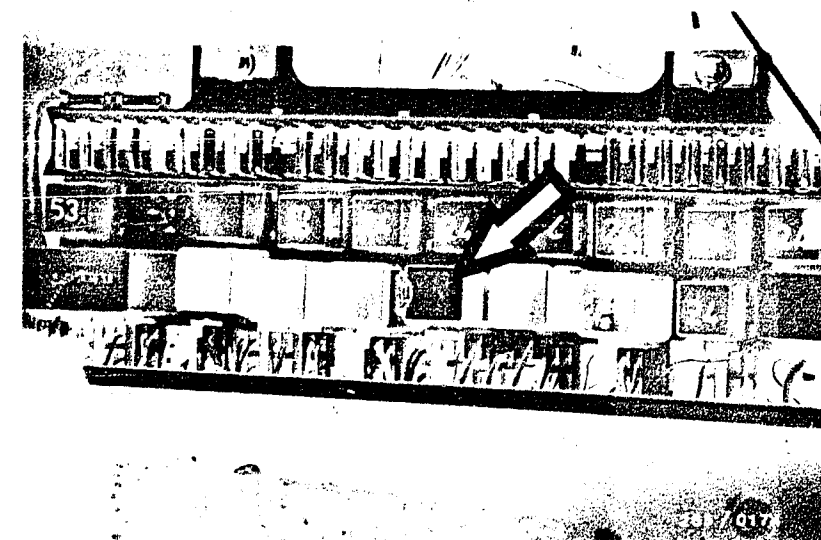
Overvoltage protection relay

Operation:

Built-in fuse and unidirectional-breakdown diode are tested.

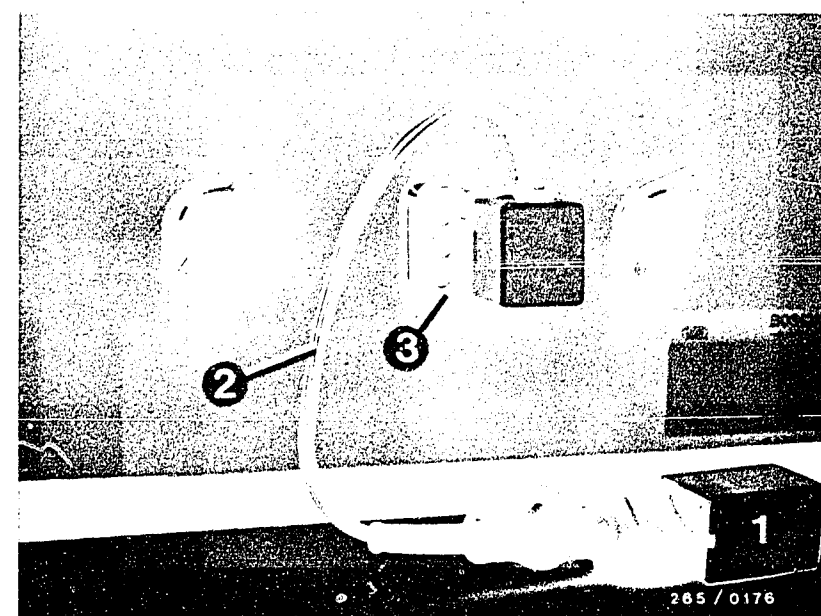
Malfunction:

Lamp 4 (red) lights up



Arrow = Overvoltage protection relay

1 = Overvoltage protection relay
2 = Adapter cable
3 = Test socket on tester



Trouble-shooting (switch off ignition):

1. Repeat test step.
2. The overvoltage protection relay plugged into the tester is defective. Check plug-in fuse in overvoltage protection relay.

C8

Test with ABS tester
Porsche 928 S

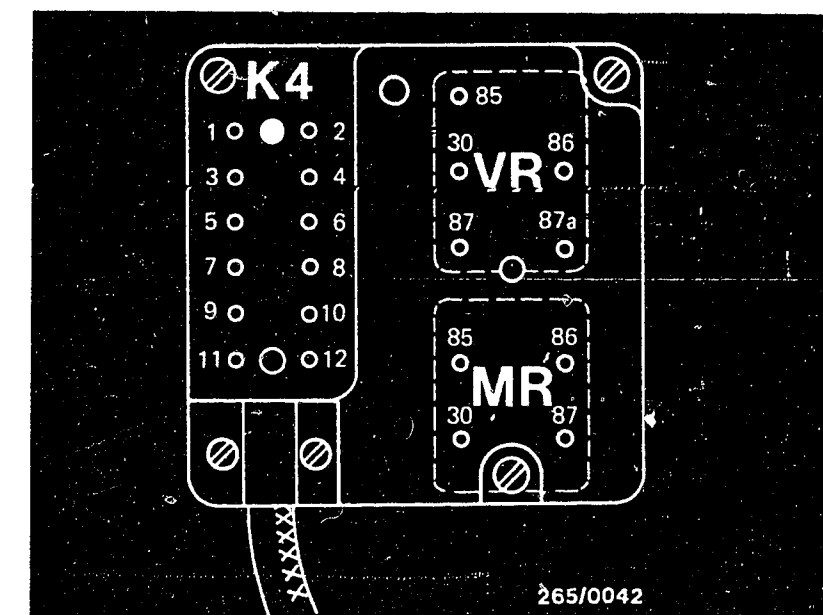


C9

Test with ABS tester
Porsche 928 S



TEST STEP 7		Reading:	Testing:
Operation:			
Program-selector switch position	6	Read off digital display unit each time after pressing a key. <u>0.7 ... 1.7 Ω</u> <u>0.7 ... 1.7 Ω</u> <u>0.7 ... 1.7 Ω</u>	Component: Hydraulic modulator
1. Press key FL	●		Operation: Valve internal resistance FL
2. Press key FR	●		Valve internal resistance FR
3. Press key RA	●		Valve internal resistance RA
Operation in vehicle: Switch on ignition.		If reading OK, continue testing with next test step.	Malfunction: Internal resistance less than 0.7 Ω or greater than 1.7 Ω



Top view of plug-in plate of hydraulic modulator

VR = Valve relay
MR = Return-pump relay
K4 = Wiring harness plug

Trouble-shooting (switch off ignition)

1. Measure internal resistance directly at hydraulic modulator:

Valve FL	between K4/term.1 and K4/term.4
Valve FR	between K4/term.3 and K4/term.4
Valve RA	between K4/term.5 and K4/term.4

Nominal value not reached:

Replace hydraulic modulator.

Continued on C12/C13

C10

Test with ABS tester
Porsche 928 S



C11

Test with ABS tester
Porsche 928 S



Trouble-shooting for TEST STEP 7 (continued)

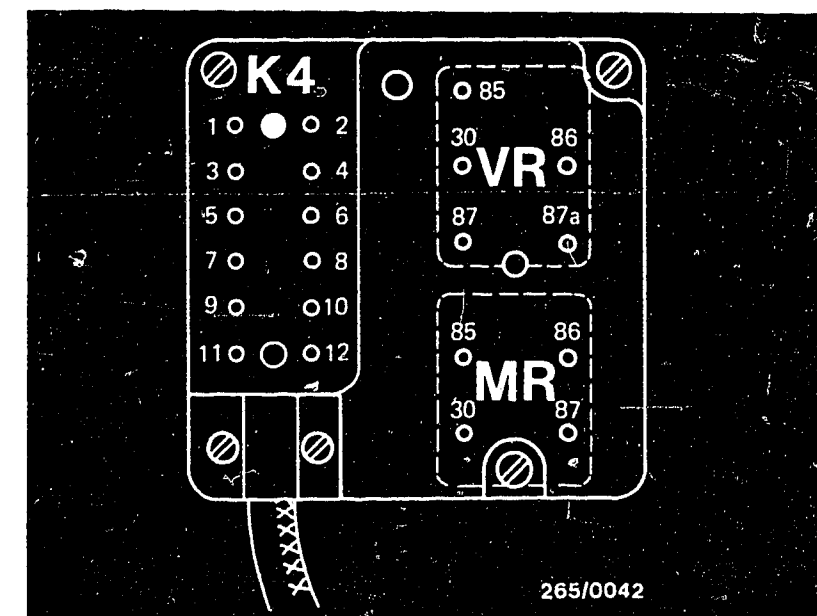
2. Test cables for continuity (set value 0 Ω)

Valve FL	between K3/term.1 and multiple plug K1/term.2
Valve FR	between K3/term.3 and multiple plug K1/term.35
Valve RA	between K3/term.5 and multiple plug K1/term.18

If open circuit:

- Check plug-in connections
- Eliminate open circuit

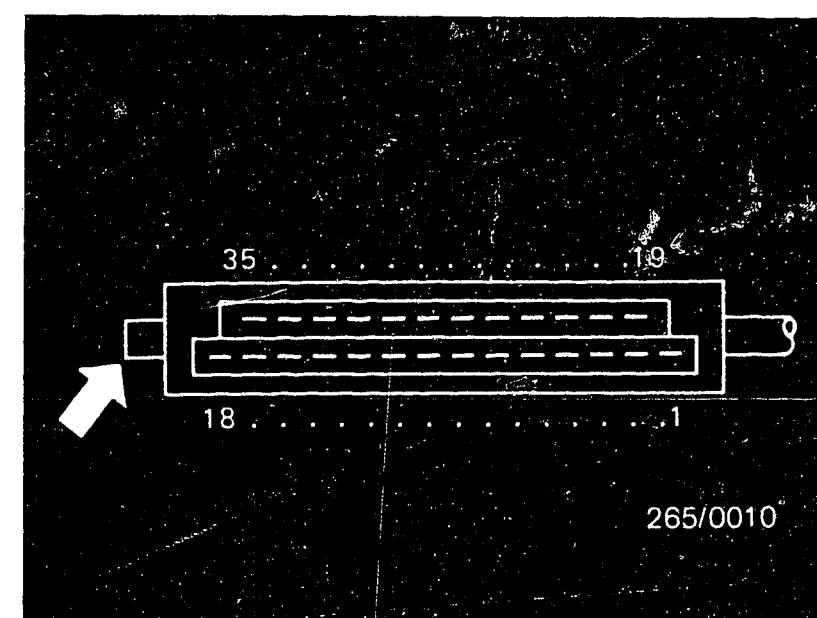
Continued on C14/C15



Top view of plug-in plate of hydraulic modulator

VR = Valve relay
MR = Return-pump relay
K4 = Wiring harness plug

Top view of multiple plug K1 (35-pin) with terminal numbers
Arrow = Lug with mechanical encoding



C12

Test with ABS tester
Porsche 928 S



C13

Test with ABS tester
Porsche 928 S

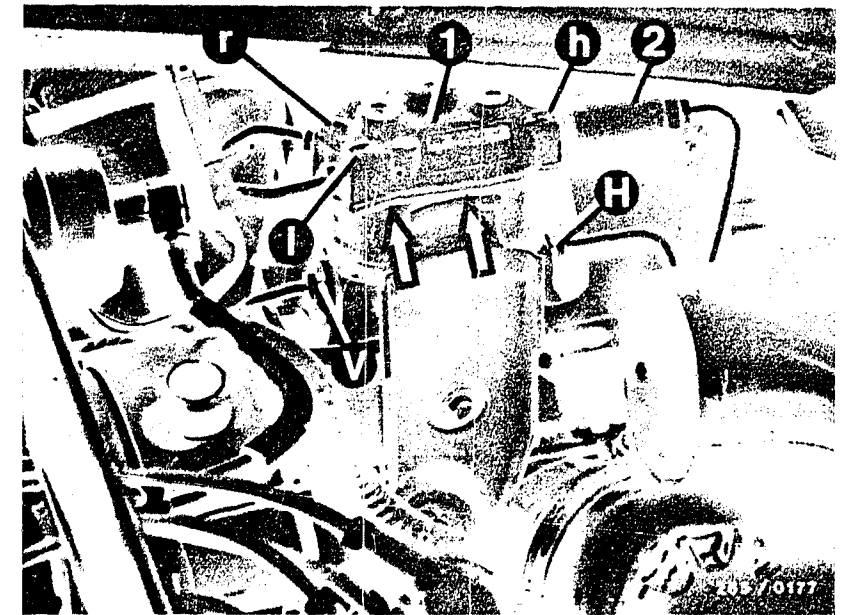


Trouble-shooting for TEST STEP 7 (continued)

Important information on replacing the hydraulic modulator

- For safety reasons, the hydraulic modulator must not be repaired, but the complete unit must be replaced.
Exceptions to this are the return-pump relay and the valve relay. Both relays may be replaced.
- Apart from the brake line connections, it is not permissible to loosen any screws on the hydraulic modulator. Under no circumstances may the hexagon-socket-head cap screws/torx screws be loosened. After loosening, it is no longer possible to get the brake circuits leak-tight, or the brake circuits can no longer be bled.
Danger!
- Check the hydraulic modulator and brake-line connections for leaks by means of a visual examination. If brake fluid is escaping, tighten the brake-line connections (12 ... 16 Nm) or replace, or replace the hydraulic modulator.

Continued on C16/C17



1 = Hydraulic modulator
2 = Load-sensing valve
Arrows = Joints

C14

Test with ABS tester
Porsche 928 S



C15

Test with ABS tester
Porsche 928 S



Trouble-shooting for TEST STEP 7 (continued)

Pay particular attention to the joints identified by arrows (top picture). On the base of the hydraulic modulator there is a vent hole to the pump pistons. A slight escape of brake fluid at this point is possible.

A complaint is only justified if, after pressing the brake pedal several times, a pool of brake fluid is formed under the hydraulic modulator.

- When removing and installing the brake lines, make sure that the lines are marked in accordance with the markings on the hydraulic modulator and that they are not mixed up when re-connecting (e.g. the connection of the hydraulic modulator marked "L" must be connected to the front left wheel-brake cylinder).

• Markings on hydraulic modulator:

l = Connection for brake line front left (wheel-brake cylinder)
r = Connection for brake line front right (wheel-brake cylinder)
h = Connection for brake line of rear axle

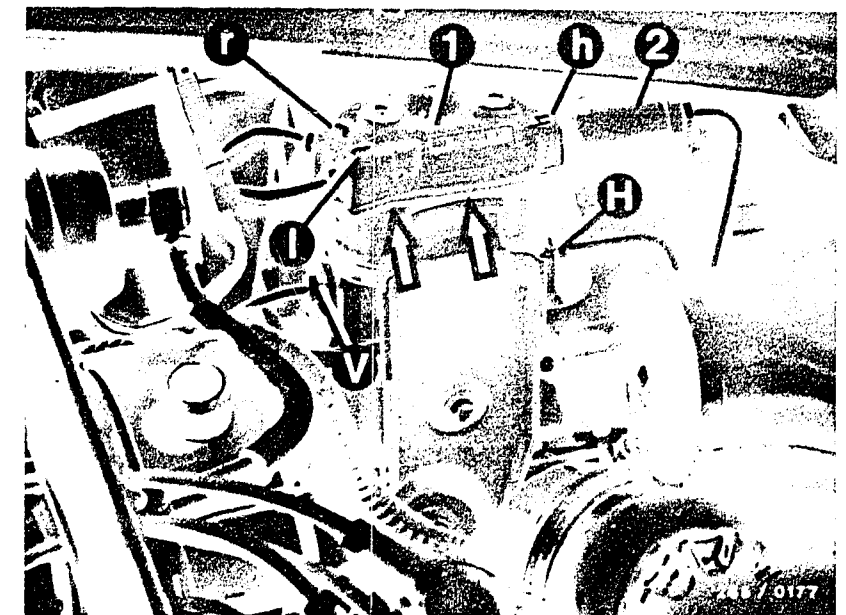
V = Front axle brake circuit from brake master cylinder
H = Rear axle brake circuit from brake master cylinder

- To remove, the left-hand front wheel must be taken off.

Removal

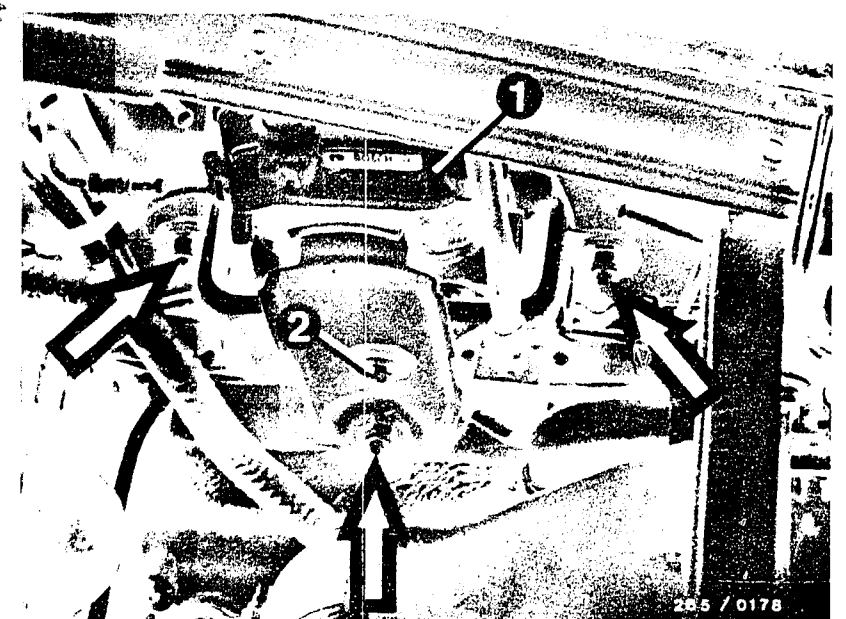
- Switch off ignition and loosen battery ground cable at bodywork.
- Remove left-hand connecting hose to air filter. Loosen supply reservoir for servo steering at bracket (leave hoses connected). Remove ignition cable from ignition coil.
- For loosening and tightening the brake lines, use only the specified double-head box wrench 9 x 11 mm.
- Mark brake lines and loosen from hydraulic modulator. Loosen load-sensing valve from hydraulic modulator.
- Catch brake fluid and do not bring into contact with hands or clothing or paintwork.
- Immediately seal brake lines and connections with dummy plugs.

Continued on C18/C19



1 = Hydraulic modulator
2 = Load-sensing valve
Arrows = Joints

1 = Hydraulic modulator
2 = Fastening screws
Arrows = Self-locking nuts



C16

Test with ABS tester
Porsche 928 S



C17

Test with ABS tester
Porsche 928 S

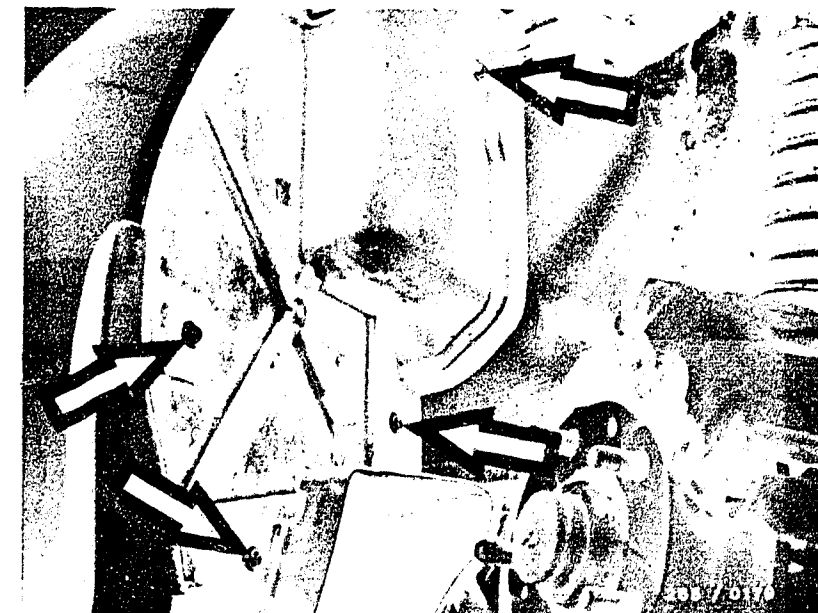


Trouble-shooting for TEST STEP 7 (continued)

- Loosen fastening screw for hydraulic modulator and self-locking nuts (3 pieces) from bracket.
- Take off left-hand front wheel.
- Unscrew wheelhouse seal.
- Unscrew hood from hydraulic modulator and take off.
- Loosen strain relief and take off plug.
- Loosen ground lead on pump motor.
- Loosen hexagon screws from bracket and take out hydraulic modulator

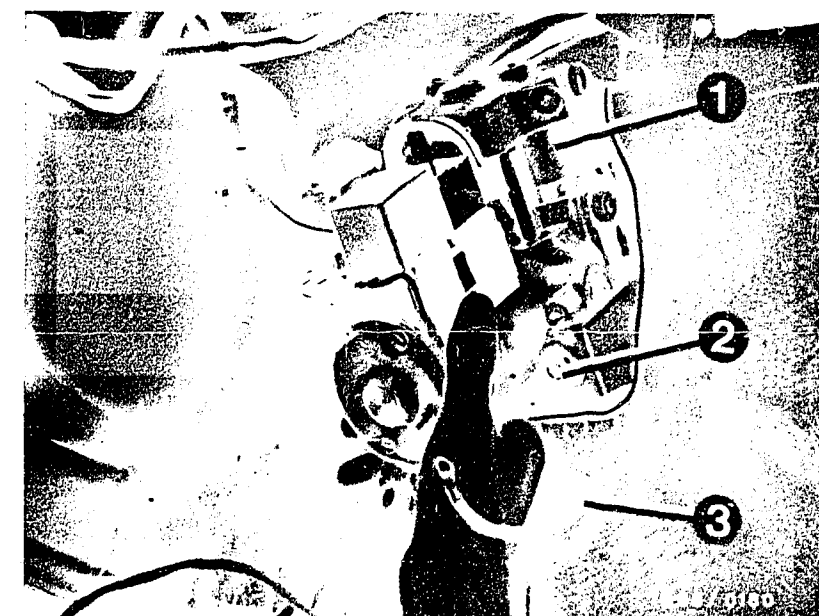
Installation

- Insert bracket for hydraulic modulator in wheelhouse and tilt downward on wheel side.
- Insert hydraulic modulator from wheel side into the bracket and screw in the 2 fastening screws, but do not tighten. Insert cable holder under the right-hand fastening screw.
- Secure bracket on wheel house with 3 self-locking nuts. If necessary, use new nuts.
- Mount hydraulic modulator in bracket. Tighten all 3 fastening screws.
- Connect ground lead to pump motor. Connect 12-pin plug and secure with strain relief.
- Mount hood with screw on hydraulic modulator
- Connect brake lines, in accordance with markings, as well as load-sensing valve to hydraulic modulator.
- Observe tightening torque for brake line connections on hydraulic modulator: 12 ... 16 Nm.
- Bleed brake system and check for leaks.
- Mount wheelhouse cover, front wheel, supply reservoir for servo steering, ignition cable on ignition coil and intake hose. Secure battery ground cable on body.
- Test ABS completely with tester.



Arrows = Fastening screws for wheelhouse cover

- 1 = Hydraulic modulator
- 2 = Fastening point on bracket
- 3 = Ground lead from pump motor



C18

Test with ABS tester

Porsche 928 S



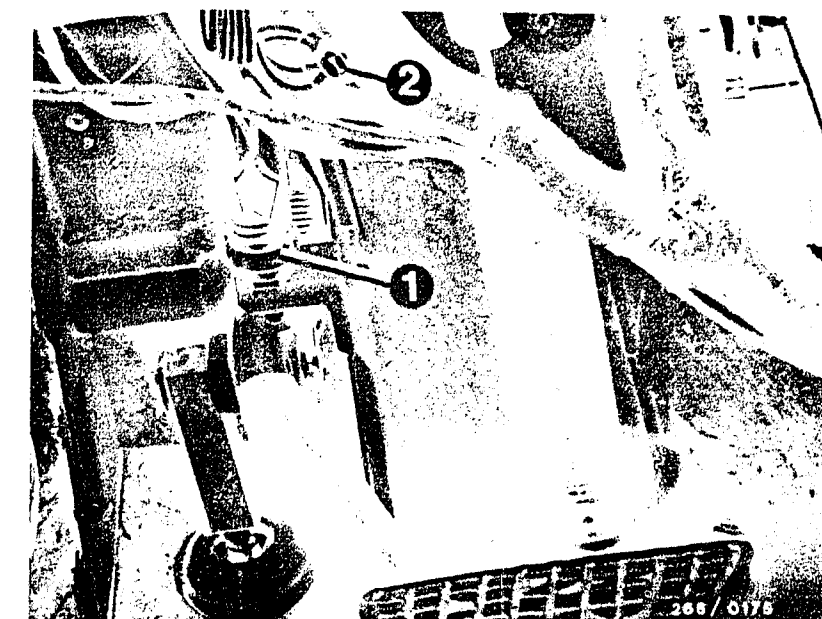
C19

Test with ABS tester

Porsche 928 S

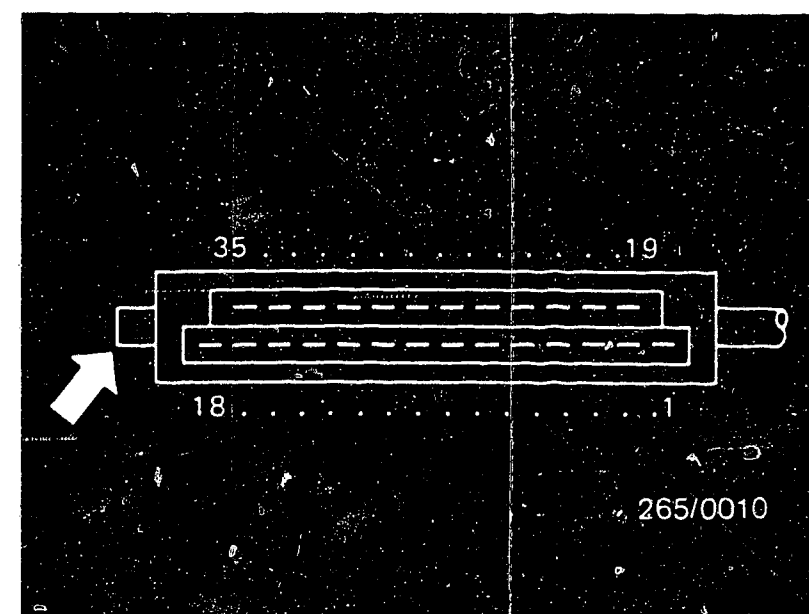


TEST STEP 8		Reading:	Testing:
Operation:			
Program-selector switch position	7	Digital display unit must indicate <u>110 ... 300 mV</u>	Component: Ground connection term. 10
Illuminated key lights up, press key	●		Operation: Contact resistance
Operation in vehicle: Switch on ignition		If reading O.K., continue testing with <u>next test step.</u>	Malfunction: Reading less than 110 mV or greater than 300 mV



- 1 = Stop-lamp
2 = ABS ground terminal on steering bracket

Top view of multiple plug K1 (35-pin) with terminal numbers
Arrow = Lug with mechanical encoding



Trouble-shooting (switch off ignition):

1. Reading less than 110 mV: Have the tester checked.
2. Reading greater than 300 mV: Check ground terminal (on steering bracket) for too high contact resistance and open circuit.
Test ground lead to multiple plug K 1/term. 10 for open circuit.

C20

Test with ABS tester
Porsche 928 S

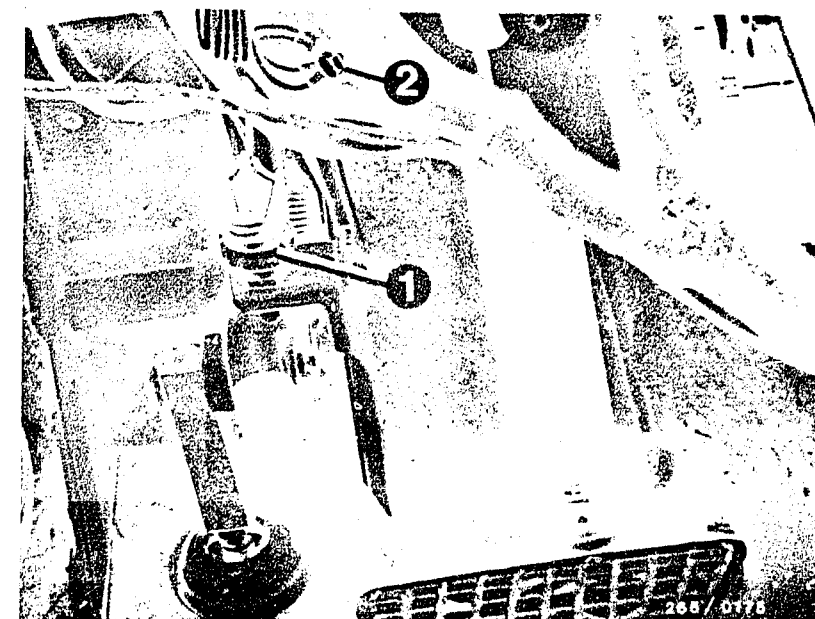


C21

Test with ABS tester
Porsche 928 S

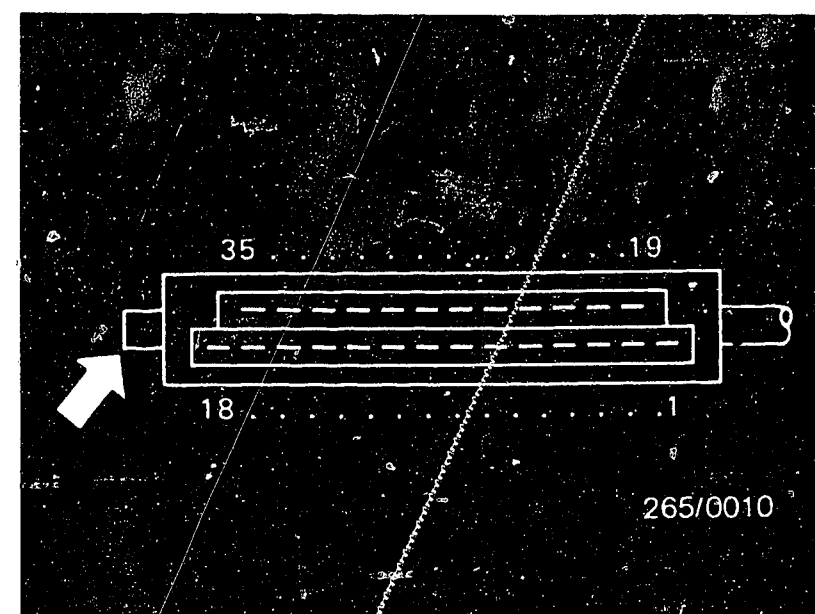


TEST STEP 9			
Operation:		Reading:	Testing:
Program-selector switch position	8	Digital display unit must indicate <u>40 ... 250 mV</u>	Component: Ground connection term. 34
Illuminated key lights up, press key	●		Operation: Contact resistance
Operation in vehicle: Switch on ignition		If reading O.K., continue testing with <u>next test step.</u>	Malfunction: Reading less than 40 mV or greater than 250 mV



1 = Stop-lamp
2 = ABS ground terminal on steering bracket

Top view of multiple plug K1 (35-pin) with terminal numbers
Arrow = Lug with mechanical encoding



Trouble-shooting (switch off ignition):

1. Reading less than 40 mV: Have the tester checked.
2. Reading greater than 250 mV: Check ground terminal (on steering bracket) for too high contact resistance and open circuit.
Test lead for open circuit:
From ground to multiple plug K1/term. 34.

C22

Test with ABS tester
Porsche 928 S



C23

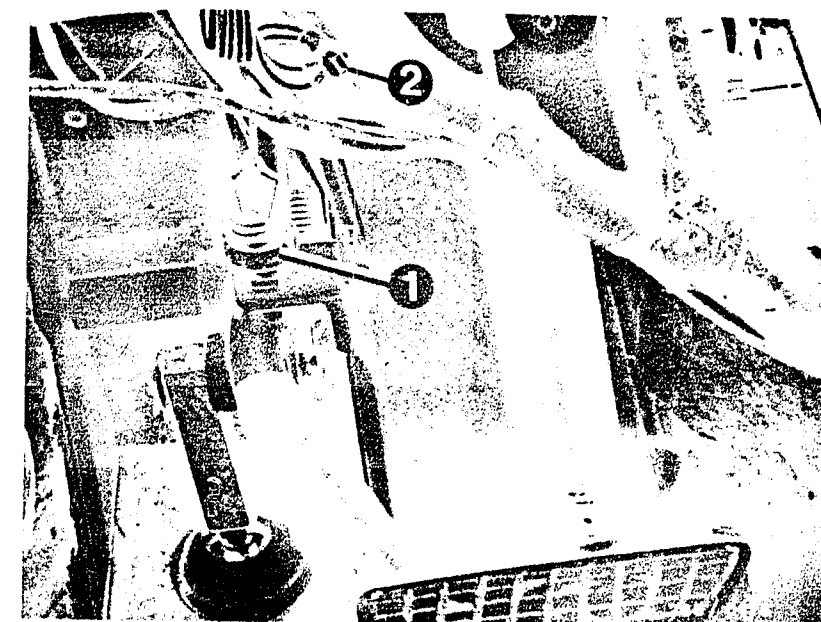
Test with ABS tester
Porsche 928 S



TEST STEP 10			
Operation:		Reading:	Testing:
Program-selector switch position	9	Digital display unit must indicate <u>40 ... 250 mV</u>	Component: Ground connection term. 20
Illuminated key lights up, press key	●		Operation: Contact resistance
Operation in vehicle: Switch on ignition		If reading O.K., continue testing with next test step.	Malfunction: Reading less than 40 mV or greater than 250 mV

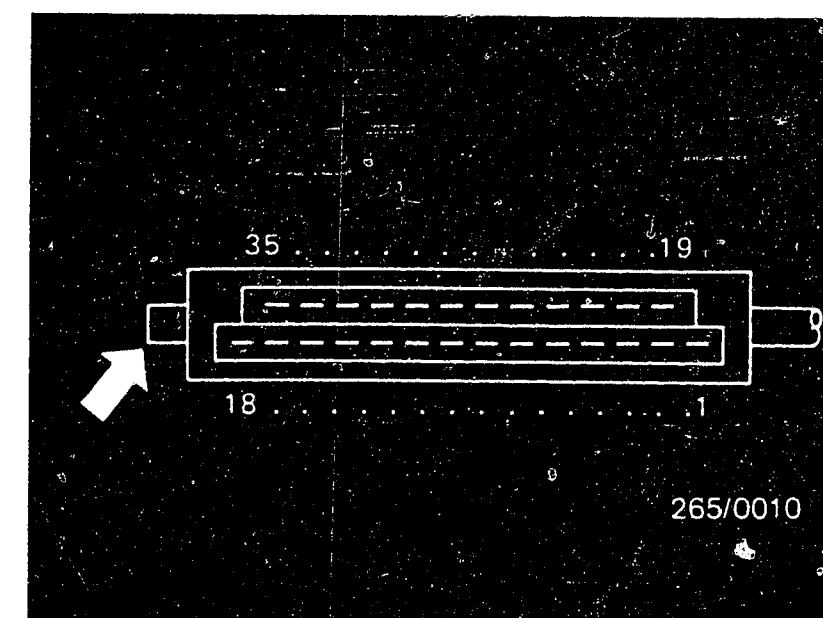
Trouble-shooting (switch off ignition):

1. Reading less than 40 mV: Have the tester checked.
2. Reading greater than 250 mV: Check ground terminal (on steering bracket) for too high contact resistance and open circuit.
Test lead open circuit:
From ground to multiple plug K1/term. 20.



1 = Stop-lamp
2 = ABS ground terminal on steering bracket

Top view of multiple plug K1 (35-pin) with terminal numbers
Arrow = Lug with mechanical encoding



D1

Test with ABS tester
Porsche 928 S

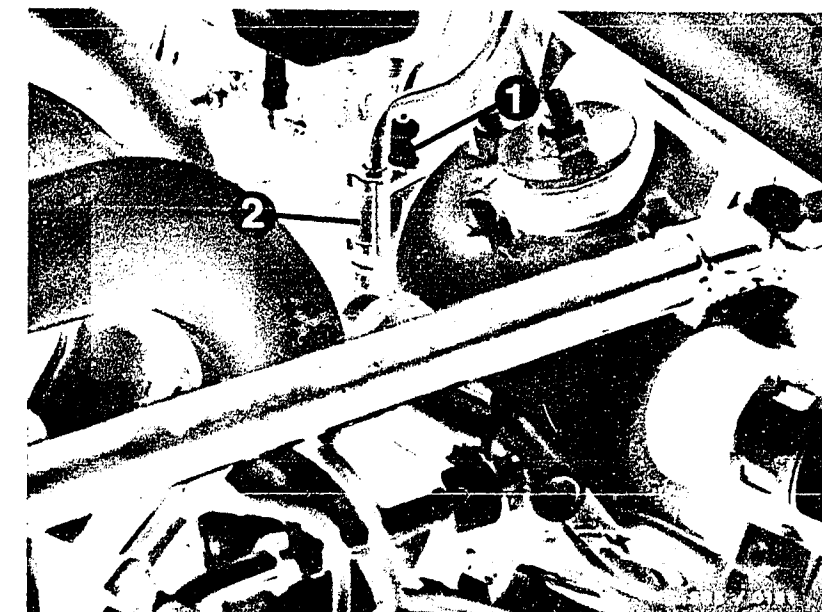


D2

Test with ABS tester
Porsche 928 S

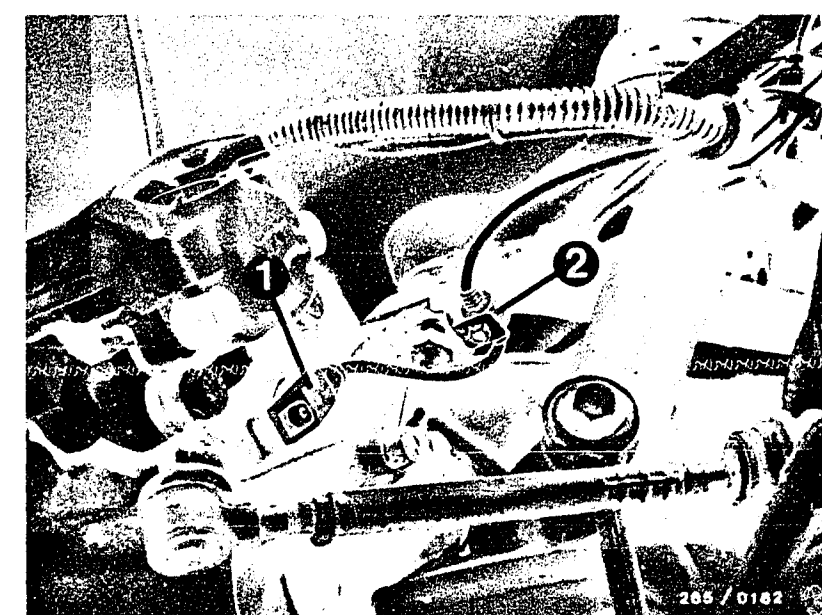


TEST STEP 11			
Operation:		Reading:	Testing:
Program-selector switch position	10	Digital display unit: for FL and FR: <u>0.8 ... 1.8 kΩ</u> ¹⁾	<u>Component:</u> Wheel-speed sensors front left and front right
Press keys FL and FR one after the other	●	If reading O.K., con- tinue testing with <u>next test step.</u>	<u>Operation:</u> Internal resistance
<u>Operation in vehicle:</u> Switch on ignition			<u>Malfunction:</u> Reading less than 0.8 k Ω or greater than 1.8 k Ω



- 1 = Wheel-speed sensor
plug-in connector
2 = Plug-in connector
for brake pad wear
indicator

- 1 = Wheel-speed sensor
2 = Cable holder



Note:¹⁾

If a vehicle is brought in with the complaint "warning lamp lighting up occasionally, but after starting again warning lamp stays off" the cause may be a loose contact in the wheel-speed leads or in the plug-in connectors of the wheel-speed sensor. The cause will be a temporary open circuit or contacting of wires which is caused by vibrations or changes in load.

Locate the fault using the following method.

Continued on D5/D6

D3

Test with ABS tester
Porsche 928 S



D4

Test with ABS tester
Porsche 928 S



Note on TEST STEP 11 (continued)

Method of testing for loose contacts with wheel-speed sensors:

- One after the other, select wheel-speed sensors by pressing key.
- On the wheel-speed sensor which has been selected, move the corresponding cable directly at the wheel-speed sensor and at the fastening points and also move the plug-in connections, also bend and pull.
- At the same time watch the digital display on the tester:
If there is a sharp change in the digital reading, there is a loose contact. In the case of an open circuit the reading becomes greater (max. 999), in the case of a short circuit (usually at the wiring-harness plug) the reading becomes smaller (min. 000).
- Replace wheel-speed sensor.
- Replace wiring harness or use repair kit from Audi or BMW

Trouble-shooting (switch off ignition)

1. Measure internal resistance at disconnected plug.

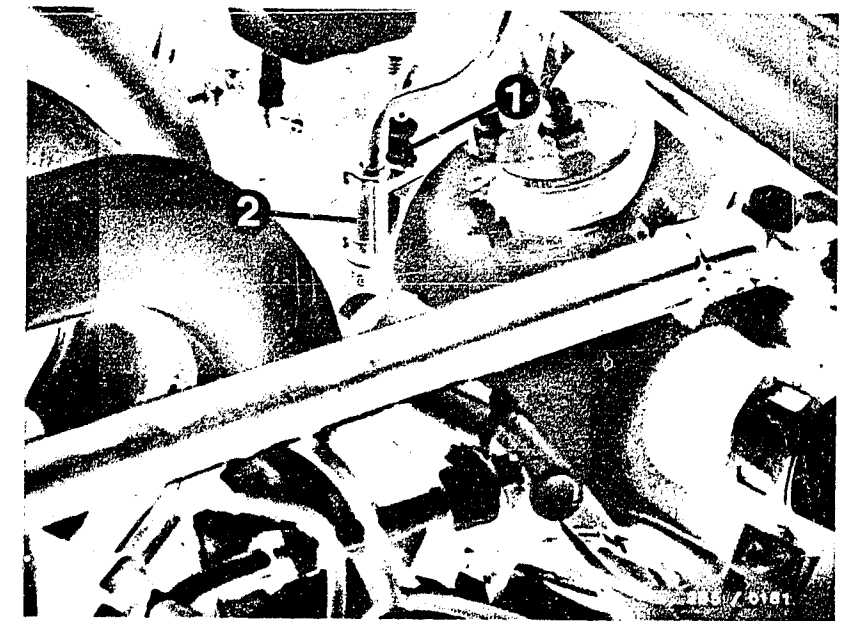
If the set value is not reached: Replace the corresponding wheel-speed sensor.

2. Test the following leads for continuity.

From plug K 11 to multiple plug K1/term. 6 and term. 4.

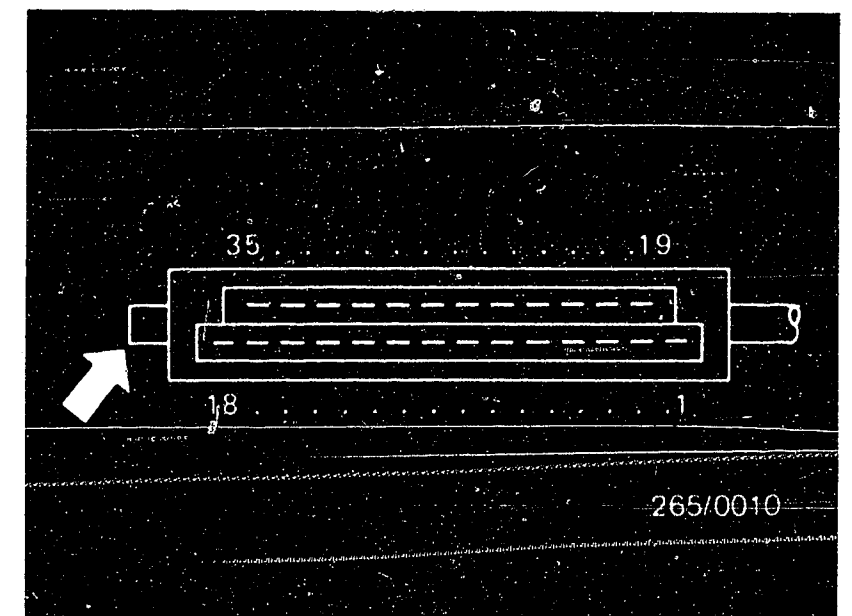
From plug K 13 to multiple plug K1/term. 23 and term. 21.

3. Check plug-in connections.



- 1 = Wheel-speed sensor
plug-in connector
- 2 = Plug-in connector
for brake pad wear
indicator

Top view of multiple plug K1
(35-pin) with terminal
numbers.
Arrow = Lug with mechanical
encoding



Continued on D7/D8

D5

Test with ABS tester
Porsche 928 S



D6

Test with ABS tester
Porsche 928 S



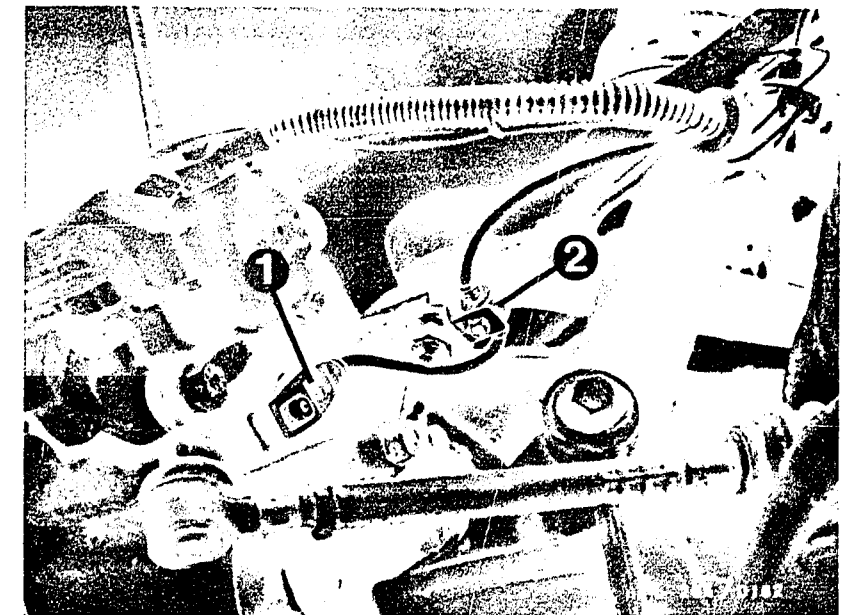
Trouble-shooting for TEST STEP 11 (continued)

Removing the wheel-speed sensors on the front axle

- Switch off ignition. Remove plug-in connector in engine compartment from holder and take apart.
- Unscrew front wheel. Remove intake hose to air filter and shielding plate of the front part of the exhaust system.
- Unclip wheel-speed sensor lead on wheelhouse and pull out with rubber grommet toward wheel side. At the same time, pull out rubber grommet of brake line.
- Unclip wheel-speed sensor lead on side member and on steering knuckle from the holders.
- Loosen hexagon-socket-head cap screw and carefully pull wheel-speed sensor out of the steering knuckle. Do not use force.

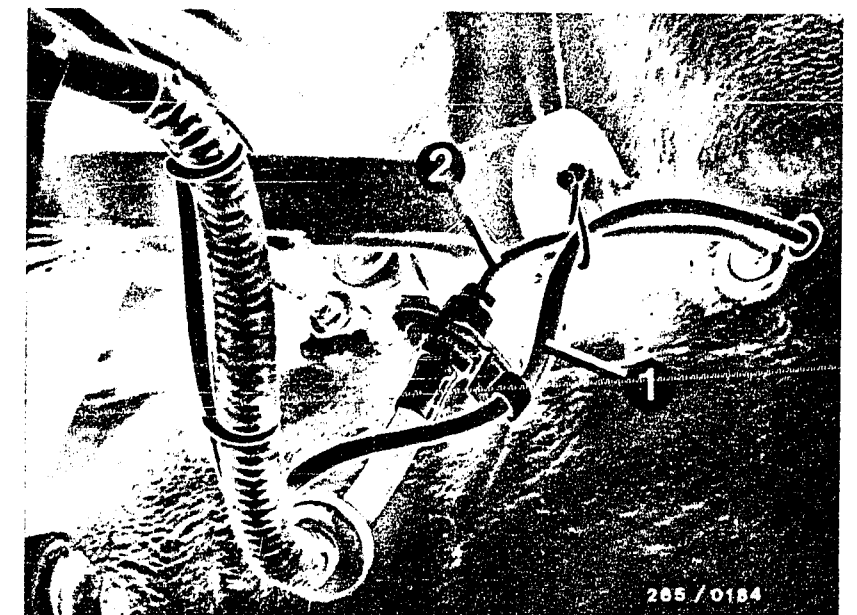
Install wheel-speed sensor on front axle.

- Check O-ring for cracks and replace if necessary.
- Only take new wheel-speed sensor out of protective sleeve when ready for mounting.
- Grease wheel-speed sensor housing lightly with Molykote Longterm 2.
- Make sure that no metallic foreign bodies are on the permanently magnetic edge.
- Carefully press wheel-speed sensor into mounting hole as far as it will go. Do not knock.
- Use new micro-encapsulated fastening screws.
Tighten fastening screws to 6...8 Nm
- Clip wheel-speed sensor lead into holders. Insert rubber grommets in holes.
- Connect wheel-speed sensor to ABS wiring harness and clip plug-in connector into holder.
- Mount exhaust system screening cover, intake hose and front wheel.
- After repairing, test with ABS tester.



1 = Wheel-speed sensor
2 = Cable holder

1 = Wheel-speed sensor lead
2 = Brake line



D7

Test with ABS tester

Porsche 928 S



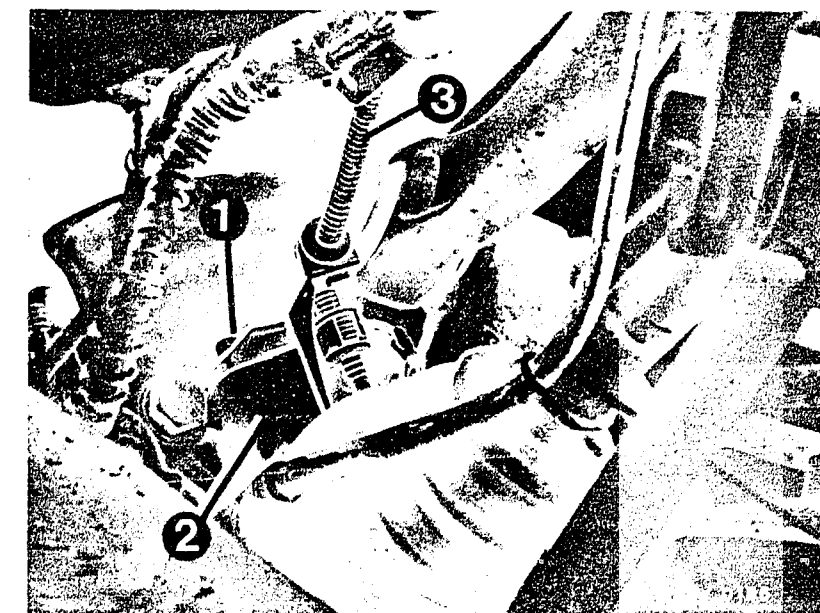
D8

Test with ABS tester

Porsche 928 S



TEST STEP 12			
Operation:		Reading:	Testing:
Program-selector switch position	10	Digital display unit must indicate <u>0.8 ... 1.8 kΩ¹⁾</u>	<u>Component:</u> Wheel-speed sensor for rear axle
Press keys RL and RR on after the other	●		<u>Operation:</u> Internal resistance
<u>Operation in vehicle:</u> Switch on ignition		If reading O.K., continue testing with <u>next test step.</u>	<u>Malfunction:</u> Reading less than 0.8 k Ω or greater than 1.8 k Ω



- 1 = Wheel-speed sensor
2 = Wheel carrier
3 = Wheel-speed sensor lead

Arrow = Wheel-speed sensor plug connector



Note: ¹⁾

If a vehicle is brought in with the complaint "warning lamp lighting up occasionally, but after starting again warning lamp stays off" the cause may be a loose contact in the wheel-speed leads or in the plug-in connectors of the wheel-speed sensor. The cause will be a temporary open circuit or contacting of wires which is caused by vibrations or changes in load.

Locate the fault using the following method.

Continued on D11/D12

D9

Test with ABS tester
Porsche 928 S



D10

Test with ABS tester
Porsche 928 S



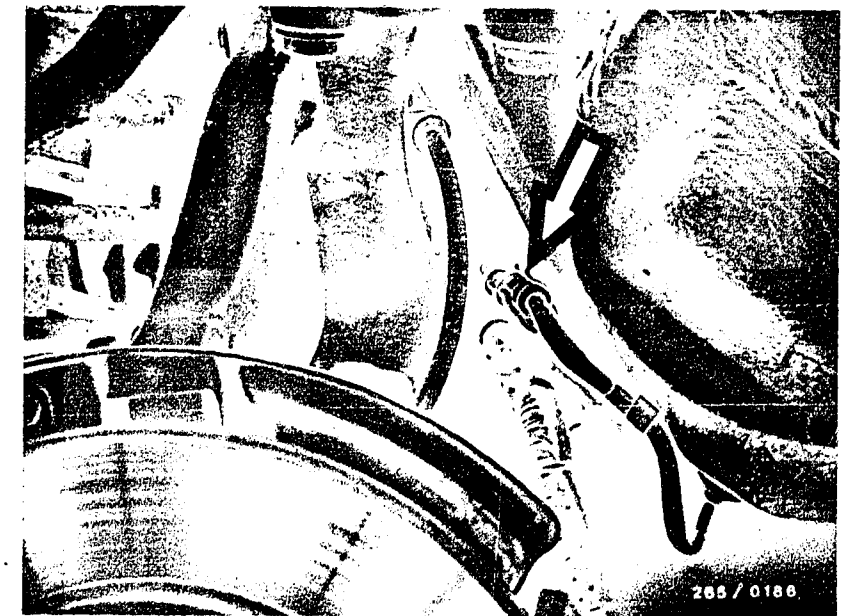
Note - TEST STEP 12 (continued)

Method of testing for loose contacts with wheel-speed sensor:

- Select wheel-speed sensor by pressing key.
- On the wheel-speed sensor which has been selected, move the corresponding cable directly at the wheel-speed sensor and at the fastening points and also move the plug-in connections, also bend and pull.
- At the same time watch the digital display on the tester:
If there is a sharp change in the digital reading, there is a loose contact. In the case of an open circuit the reading becomes greater (max. 999), in the case of a short circuit (usually at the wiring-harness plug) the reading becomes smaller (min. 000).
- Replace wheel-speed sensor.
- Replace wiring harness or use repair kit from Audi or BMW

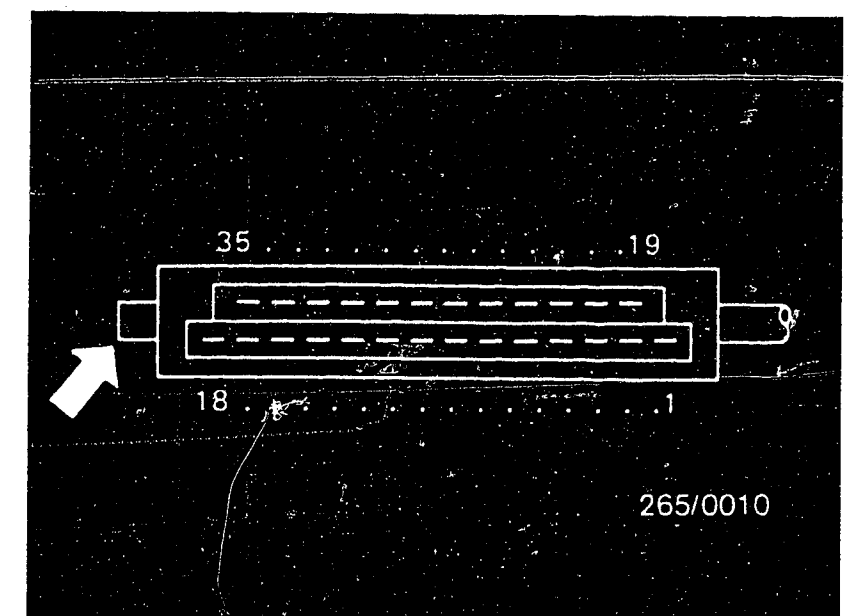
Trouble-shooting (switch off ignition)

1. Measure internal resistance at disconnected plug.
If the set value is not reached: Replace the corresponding wheel-speed sensor.
2. Test the following leads for continuity.
From plug K 15 to multiple plug K1/term. 7 and term. 9.
From plug K 17 to multiple plug K1/term. 24 and term. 26.
3. Check plug-in connections.



Arrow = Wheel-speed sensor
plug connector

Top view of multiple plug
K1 (35-pin) with terminal
numbers.
Arrow = Lug with mechanical
encoding



Continued on D13/D14

D11

Test with ABS tester
Porsche 928 S



D12

Test with ABS tester
Porsche 928 S



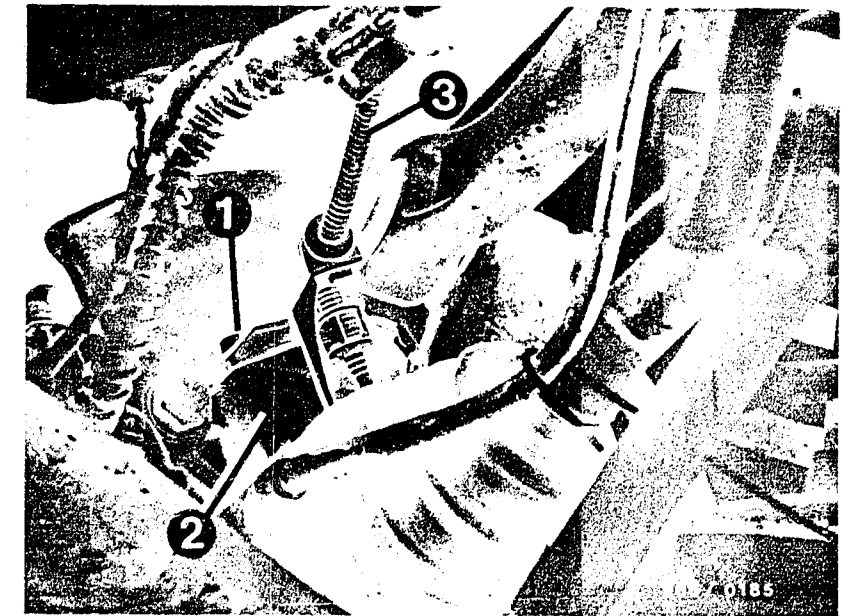
Trouble-shooting for TEST STEP 12 (continued)

Removing the wheel-speed sensors on the rear axle

- Unscrew the rear wheel.
- Switch off ignition. Take plug-in connector out of holder and take apart.
- Unclip wheel-speed sensor lead from rear-axle cross member and wheel carrier.
- Loosen hexagon-socket-head cap screw and carefully pull wheel-speed sensor out of wheel carrier. Do not use force.

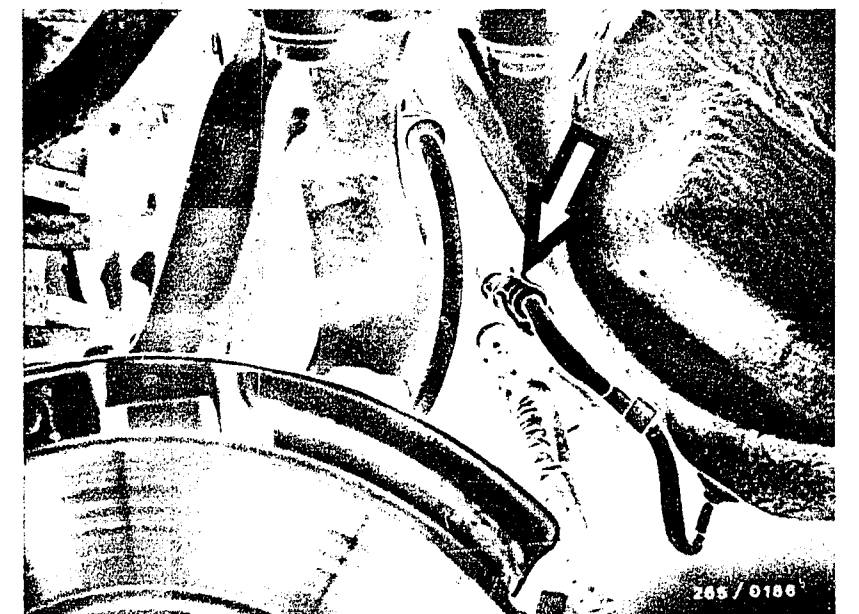
Installing the wheel-speed sensors on the rear axle

- Check O-ring for cracks and replace if necessary.
- Only take new wheel-speed sensor out of protective sleeve when ready for mounting.
- Grease wheel-speed sensor housing lightly with Molykote Longterm 2.
- Make sure that no metallic foreign bodies are on the permanently magnetic edge.
- Carefully press wheel-speed sensor into mounting hole as far as it will go. Do not knock.
- Use new micro-encapsulated fastening screw.
Tighten fastening screws to 6 ... 8 Nm.
- Clip wheel-speed sensor into the holders on wheel carrier and rear-axle member.
- Connect wheel-speed sensor to ABS wiring harness and clip plug connector into holder.
- Mount rear wheel.
- After repairing, perform test with ABS tester.



- 1 = Wheel-speed sensor
- 2 = Wheel carrier
- 3 = Wheel-speed sensor lead

Arrow = Wheel-speed sensor
plug connector



D13

Test with ABS tester
Porsche 928 S



D14

Test with ABS tester
Porsche 928 S



TEST STEP 13			
Operation:		Reading:	Testing:
Program-selector switch position	11	Digital display unit: for FL and FR: 20 ... 999 k Ω	Component: Wheel-speed sensors front left and front right
Press keys FL and FR one after the other	●		Operation: Insulation resistance
Operation in vehicle: Switch on ignition			Malfunction: Reading less than 20 k Ω

Trouble-shooting (switch off ignition):

Plug connectors OK?

Undo plug connectors and bridge the plug leading to the tester using wire.

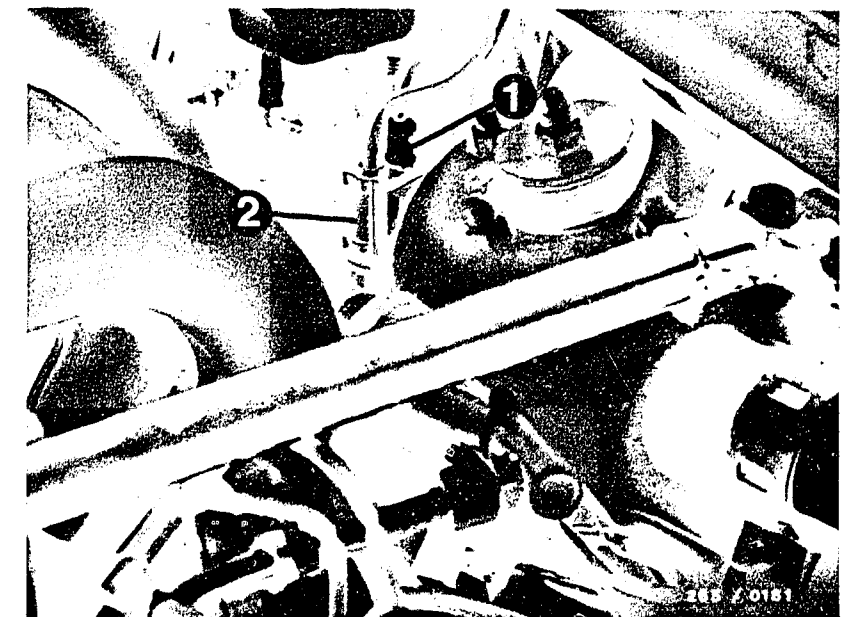
Repeat test:

If reading now OK, replace wheel-speed sensor.

If reading still below the nominal value, the cables from multiple plug term.6 and term.4 or term.23 and term.21 to the respective plug are defective.

Check all cables for wear and short circuit to ground.

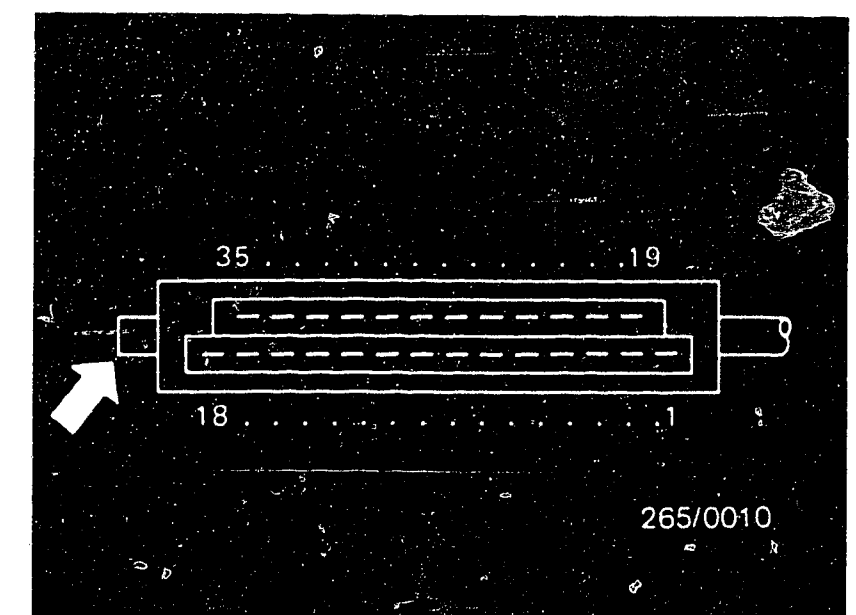
Continued on D17/D18



- 1 = Wheel-speed sensor plug-in connector
- 2 = Plug-in connector for brake pad wear indicator

Top view of multiple plug K1 (35-pin) with terminal numbers.

Arrow = Lug with mechanical encoding



D15

Test with ABS tester
Porsche 928 S



D16

Test with ABS tester
Porsche 928 S



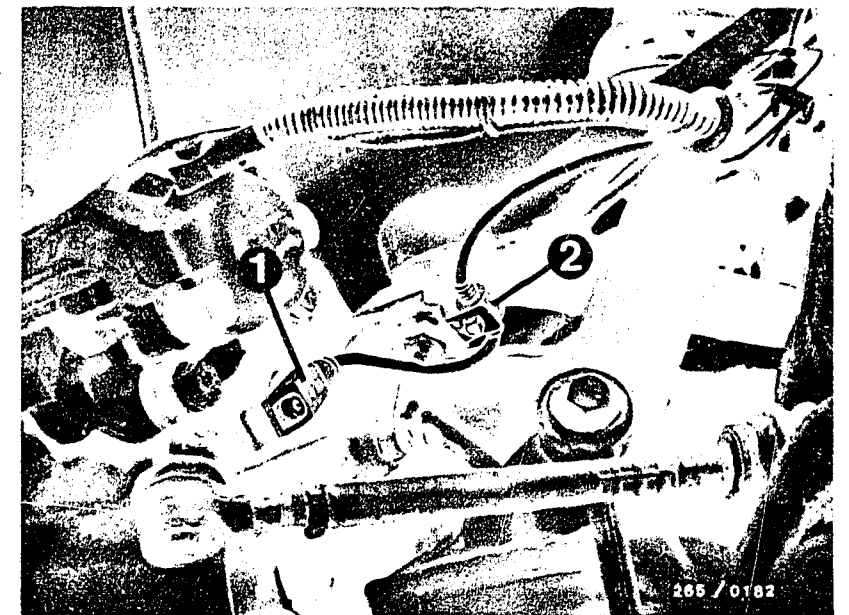
Trouble-shooting for TEST STEP 13 (continued)

Removing the wheel-speed sensors on the front axle

- Switch off ignition. Remove plug-in connector in engine compartment from holder and take apart.
- Unscrew front wheel. Remove intake hose to air filter and shielding plate of the front part of the exhaust system.
- Unclip wheel-speed sensor lead on wheelhouse and pull out with rubber grommet toward wheel side. At the same time, pull out rubber grommet of brake line.
- Unclip wheel-speed sensor lead on side member and on steering knuckle from the holders.
- Loosen hexagon-socket-head cap screw and carefully pull wheel-speed sensor out of the steering knuckle. Do not use force.

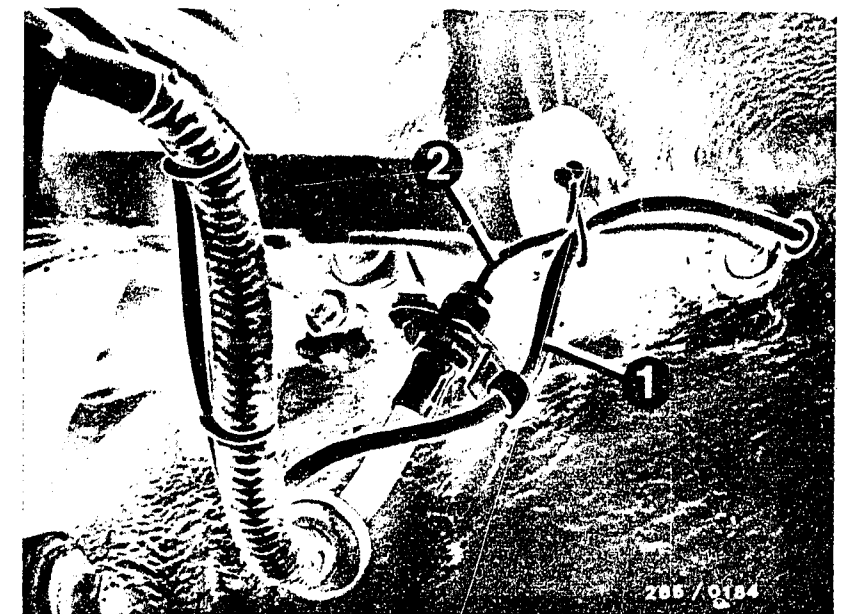
Install wheel-speed sensor on front axle.

- Check O-ring for cracks and replace if necessary.
- Only take new wheel-speed sensor out of protective sleeve when ready for mounting.
- Grease wheel-speed sensor housing lightly with Molykote Longterm 2.
- Make sure that no metallic foreign bodies are on the permanently magnetic edge.
- Carefully press wheel-speed sensor into mounting hole as far as it will go. Do not knock.
- Use new micro-encapsulated fastening screws.
Tighten fastening screws to 6...8 Nm
- Clip wheel-speed sensor lead into holders. Insert rubber grommets in holes.
- Connect wheel-speed sensor to ABS wiring harness and clip plug-in connector into holder.
- Mount exhaust system screening cover, intake hose and front wheel.
- After repairing, test with ABS tester.



1 = Wheel-speed sensor
2 = Cable holder

1 = Wheel-speed sensor lead
2 = Brake line



D17

Test with ABS tester
Porsche 928 S

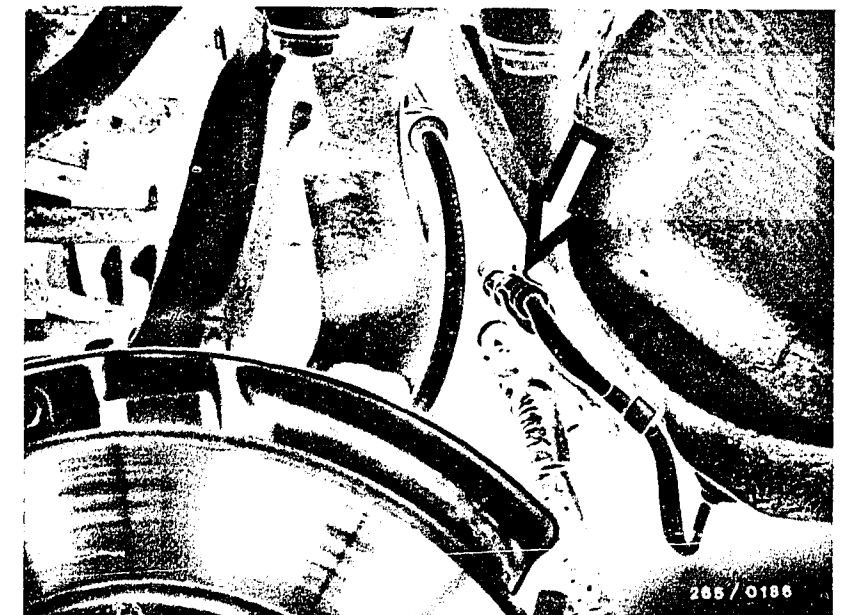


D18

Test with ABS tester
Porsche 928 S

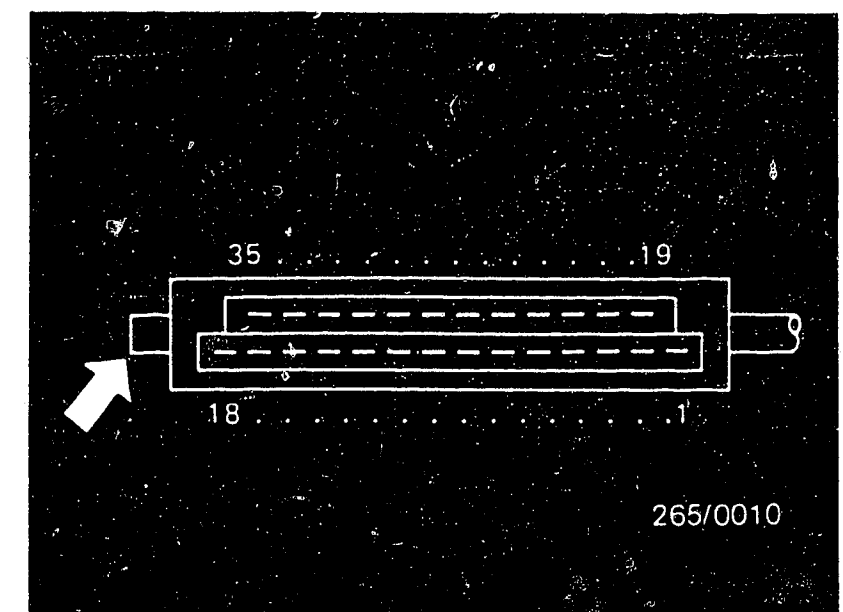


TEST STEP 14			
Operation:		Reading:	Testing:
Program-selector switch position	11	Digital display unit: <u>20 ... 999 kΩ</u>	<u>Component:</u> Wheel-speed sensors rear left and rear right
Press keys RL and RR one after the other.	●		<u>Operation:</u> Insulation resistance
<u>Operation in vehicle:</u> Switch on ignition		If reading O.K., continue testing with <u>next test step.</u>	<u>Malfunction:</u> Reading less than 20 k Ω



Arrow = Wheel-speed sensor plug connector

Top view of multiple plug K1 (35-pin) with terminal numbers
Arrow = Lug with mechanical plug



Trouble-shooting (switch off ignition)

Plug-in connection O.K.?

Take apart plug-in connectors and, using wire, jump the plug leading to the tester.

Repeat test: If reading now O.K., replace wheel speed sensor. If the reading is still less than the set value, the leads from the multiple plug term. 7 and term. 9 or term. 24 and term. 26 to the respective connector are defective.

Check all cables for wear and short circuit to ground

Continued on D21/D22

D 19

Test with ABS tester
Porsche 928 S



D 20

Test with ABS tester
Porsche 928 S



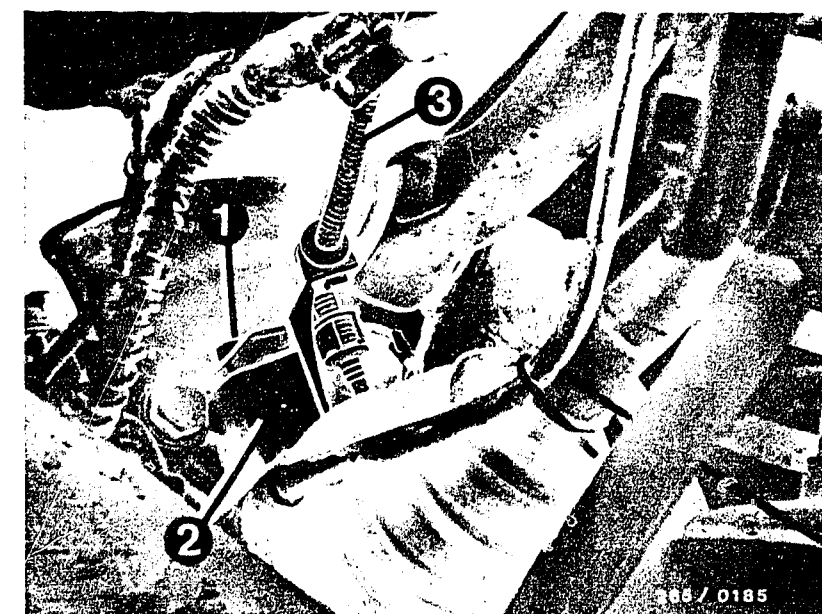
Trouble-shooting for TEST STEP 14 (continued)

Removing the wheel-speed sensors on the rear axle

- Unscrew the rear wheel.
- Switch off ignition. Take plug-in connector out of holder and take apart.
- Unclip wheel-speed sensor lead from rear-axle cross member and wheel carrier.
- Loosen hexagon-socket-head cap screw and carefully pull wheel-speed sensor out of wheel carrier. Do not use force.

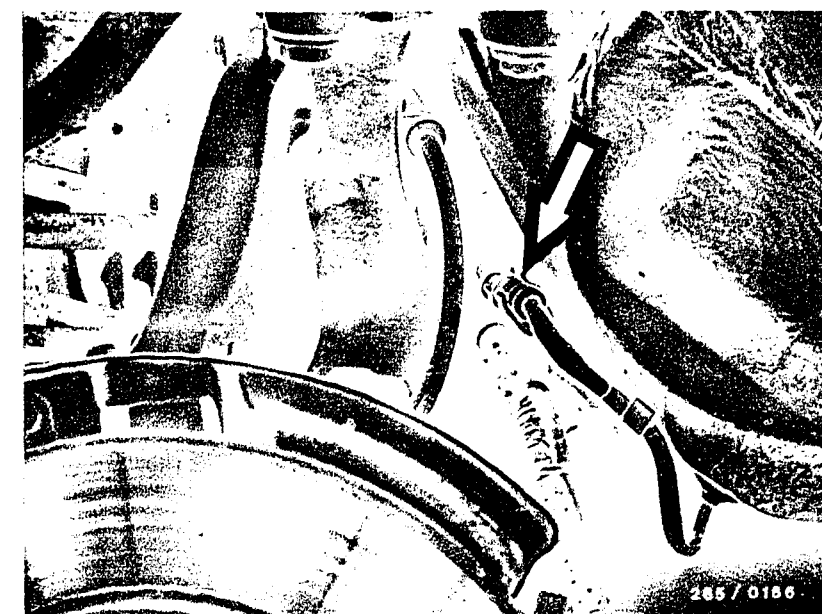
Installing the wheel-speed sensors on the rear axle

- Check O-ring for cracks and replace if necessary.
- Only take new wheel-speed sensor out of protective sleeve when ready for mounting.
- Grease wheel-speed sensor housing lightly with Molykote Longterm 2.
- Make sure that no metallic foreign bodies are on the permanently magnetic edge.
- Carefully press wheel-speed sensor into mounting hole as far as it will go. Do not knock.
- Use new micro-encapsulated fastening screw. Tighten fastening screws to 6 ... 8 Nm.
- Clip wheel-speed sensor into the holders on wheel carrier and rear-axle member.
- Connect wheel-speed sensor to ABS wiring harness and clip plug connector into holder.
- Mount rear wheel.
- After repairing, perform test with ABS tester.



- 1 = Wheel-speed sensor
- 2 = Wheel carrier
- 3 = Wheel-speed sensor lead

Arrow = Wheel-speed sensor
plug connector



D21

Test with ABS tester
Porsche 928 S

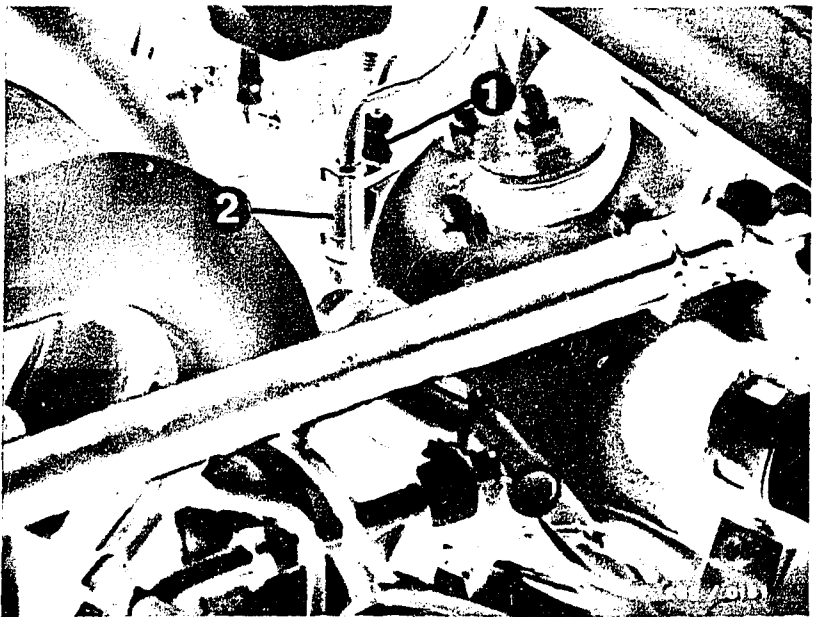


D22

Test with ABS tester
Porsche 928 S



TEST STEP 15			
Operation:		Reading:	Testing:
Program-selector switch position	12	Digital display unit: for FL and FR: <u>0 ... 100 mV</u>	Component: Wheel-speed sensors front left and front right
Press keys FL and FR one after the other	●		Operation: DC voltage on cable
Operation in vehicle: Switch on ignition			Malfunction: Reading greater than 100 mV



Arrow = Wheel-speed sensor plug connector

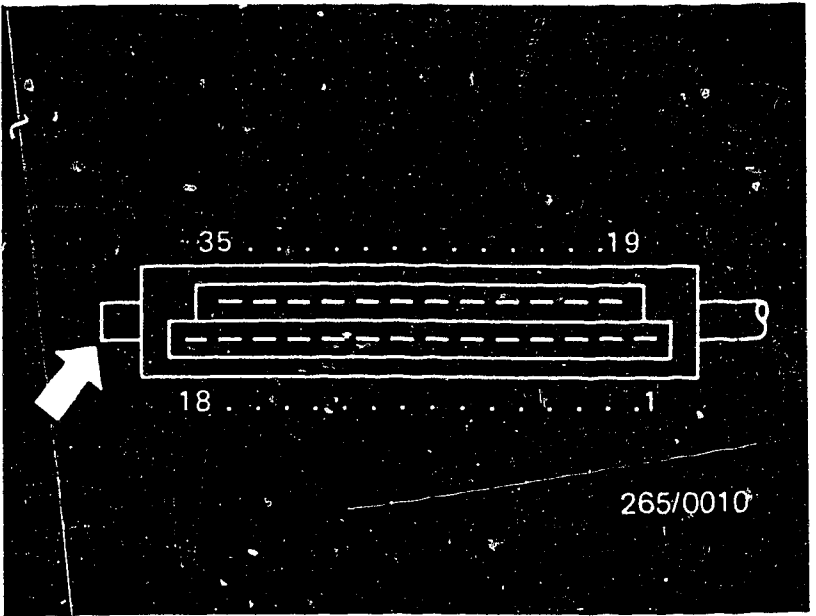
Top view of multiple plug K1 (35-pin) with terminal numbers
Arrow = Lug with mechanical plug

Trouble-shooting (switch off ignition)

Plug-in connection O.K.?
Undo plug connector and bridge the connector leading to the tester with a lead.
Repeat test: If reading is now O.K., replace wheel-speed sensor.
If reading is still under the set value, the leads from multiple plug term. 6 and term. 4 or term. 23 and 21 to the plug are defective.

Check all cables for wear and short circuit to ground.

Continued on E1/E2



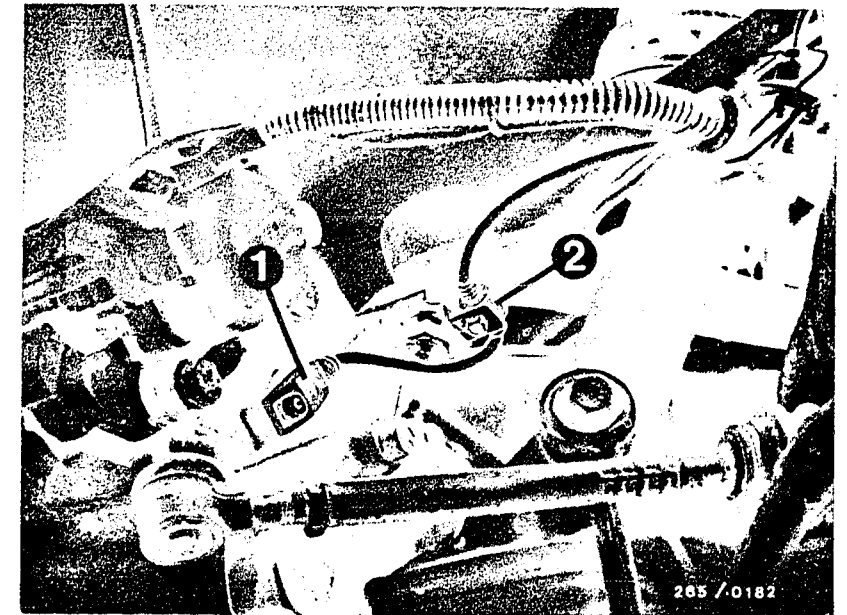
Trouble-shooting for TEST STEP 15 (continued)

Removing the wheel-speed sensors on the front axle

- Switch off ignition. Remove plug-in connector in engine compartment from holder and take apart.
- Unscrew front wheel. Remove intake hose to air filter and shielding plate of the front part of the exhaust system.
- Unclip wheel-speed sensor lead on wheelhouse and pull out with rubber grommet toward wheel side. At the same time, pull out rubber grommet of brake line.
- Unclip wheel-speed sensor lead on side member and on steering knuckle from the holders.
- Loosen hexagon-socket-head cap screw and carefully pull wheel-speed sensor out of the steering knuckle. Do not use force.

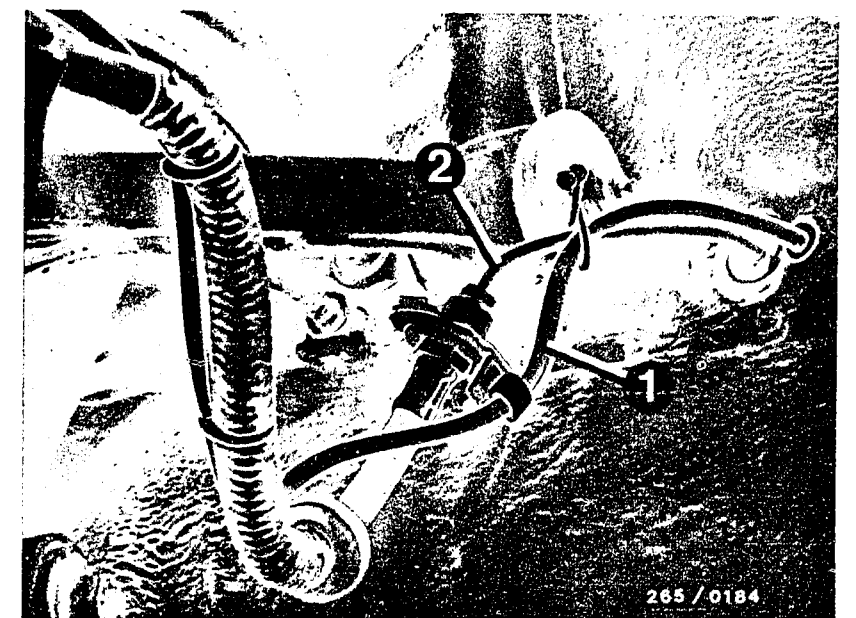
Install wheel-speed sensor on front axle.

- Check O-ring for cracks and replace if necessary.
- Only take new wheel-speed sensor out of protective sleeve when ready for mounting.
- Grease wheel-speed sensor housing lightly with Molykote Longterm 2.
- Make sure that no metallic foreign bodies are on the permanently magnetic edge.
- Carefully press wheel-speed sensor into mounting hole as far as it will go. Do not knock.
- Use new micro-encapsulated fastening screws.
Tighten fastening screws to 6...8 Nm
- Clip wheel-speed sensor lead into holders. Insert rubber grommets in holes.
- Connect wheel-speed sensor to ABS wiring harness and clip plug-in connector into holder.
- Mount exhaust system screening cover, intake hose and front wheel.
- After repairing, test with ABS tester.



1 = Wheel-speed sensor
2 = Cable holder

1 = Wheel-speed sensor lead
2 = Brake line



E1

Test with ABS tester
Porsche 928 S



E2

Test with ABS tester
Porsche 928 S



TEST STEP 16			
Operation:		Reading:	Testing:
Program-selector switch position	12	Digital display unit: <u>0 ... 100 mV</u>	<u>Component:</u> Wheel-speed sensors rear left and rear right
Press keys RL and RR one after the other.	●		<u>Operation:</u> DC voltage on line
<u>Operation in vehicle:</u> Switch on ignition		If reading O.K., continue testing with next test step.	<u>Malfunction:</u> Reading greater than 100 mV

Trouble-shooting (switch off ignition)

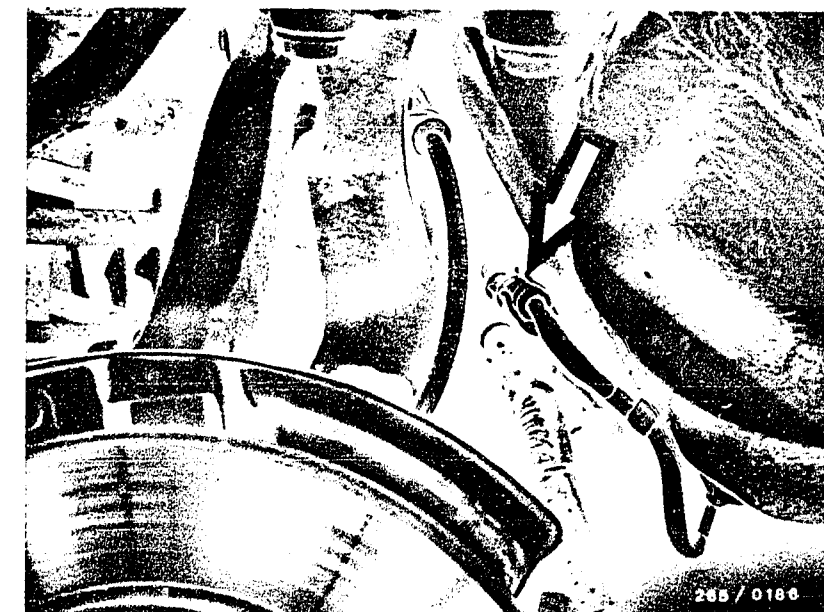
Plug-in connection O.K.?

Take apart plug-in connectors and, using wire, jump the plug leading to the tester.

Repeat test: If reading now O.K., replace wheel speed sensor. If the reading is still less than the set value, the leads from the multiple-plug term. 7 and term. 9 or term. 24 and term. 26 to the respective connector are defective.

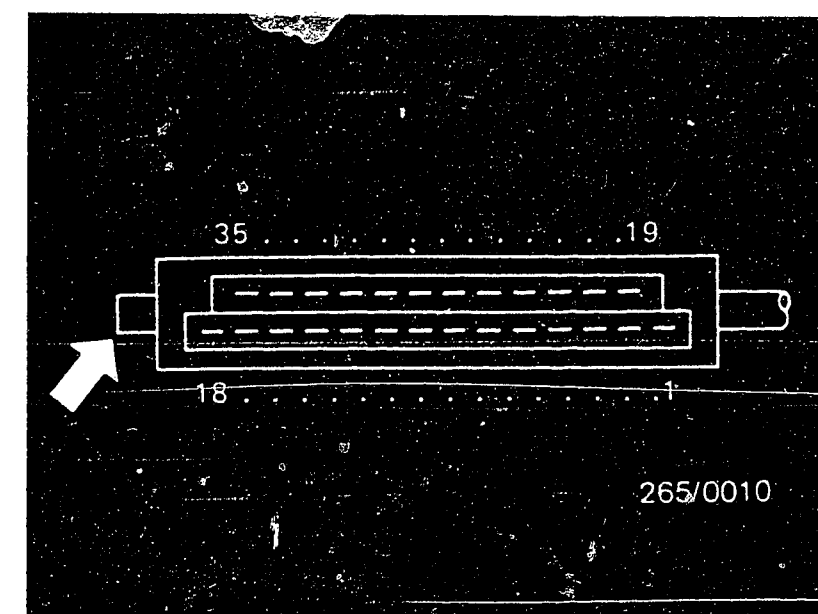
Check all cables for wear and short circuit to ground

Continued on E5/E6



Arrow = Wheel-speed sensor plug connector

Top view of multiple plug K1 (35-pin) with terminal numbers
Arrow = Lug with mechanical plug



E3

Test with ABS tester
Porsche 928 S



E4

Test with ABS tester
Porsche 928 S



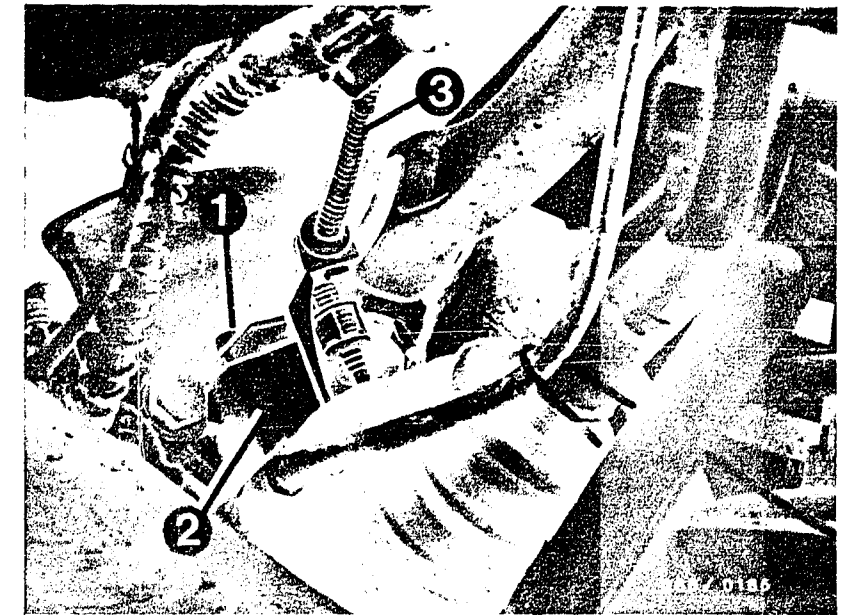
Trouble-shooting for TEST STEP 16 (continued)

Removing the wheel-speed sensors on the rear axle

- Unscrew the rear wheel.
- Switch off ignition. Take plug-in connector out of holder and take apart.
- Unclip wheel-speed sensor lead from rear-axle cross member and wheel carrier.
- Loosen hexagon-socket-head cap screw and carefully pull wheel-speed sensor out of wheel carrier. Do not use force.

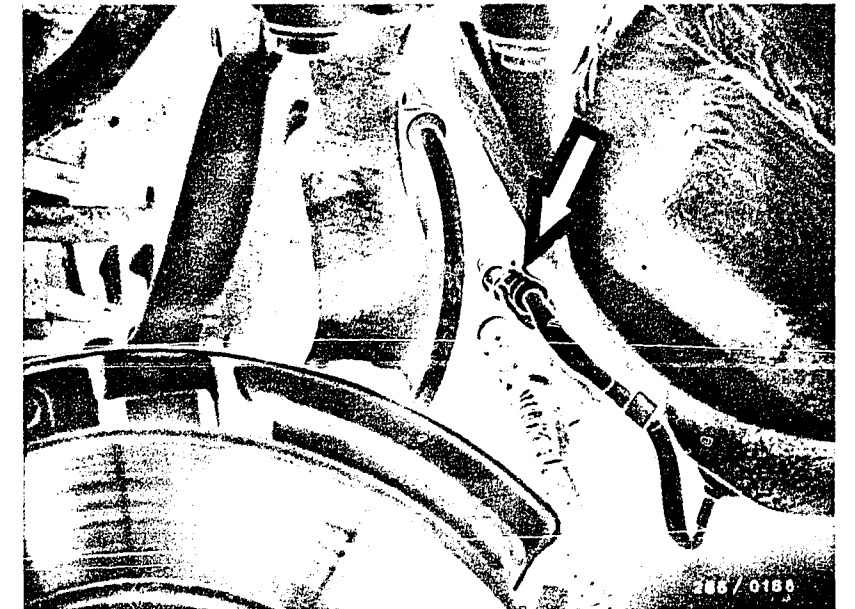
Installing the wheel-speed sensors on the rear axle

- Check O-ring for cracks and replace if necessary.
- Only take new wheel-speed sensor out of protective sleeve when ready for mounting.
- Grease wheel-speed sensor housing lightly with Molykote Longterm 2.
- Make sure that no metallic foreign bodies are on the permanently magnetic edge.
- Carefully press wheel-speed sensor into mounting hole as far as it will go. Do not knock.
- Use new micro-encapsulated fastening screw.
Tighten fastening screws to 6 ... 8 Nm.
- Clip wheel-speed sensor into the holders on wheel carrier and rear-axle member.
- Connect wheel-speed sensor to ABS wiring harness and clip plug connector into holder.
- Mount rear wheel.
- After repairing, perform test with ABS tester.



- 1 = Wheel-speed sensor
- 2 = Wheel carrier
- 3 = Wheel-speed sensor lead

Arrow = Wheel-speed sensor
plug connector



E5

Test with ABS tester
Porsche 928 S

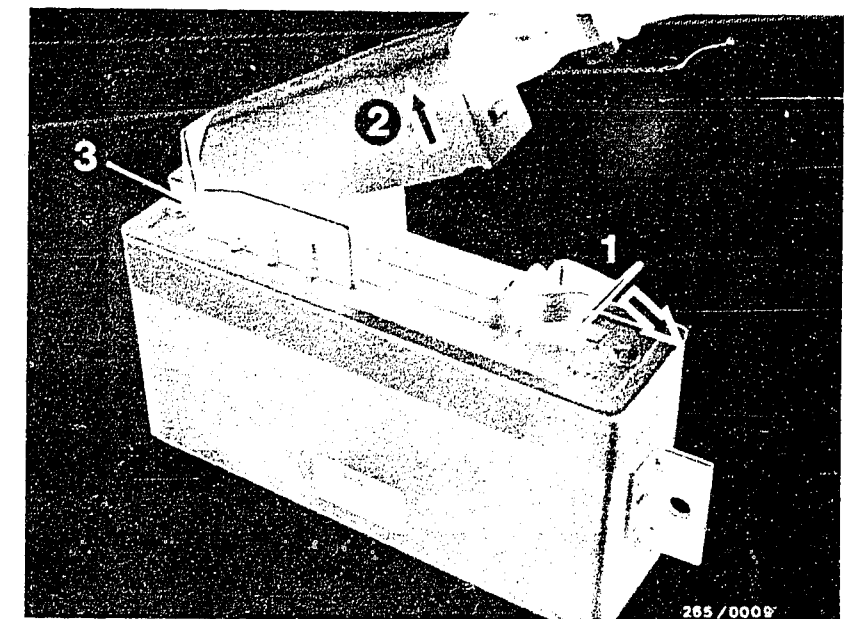


E6

Test with ABS tester
Porsche 928 S



TEST STEP 17			
Operation:		Reading:	Testing:
Program-selector switch position	13	Digital display unit: 4.75 ... 5.25 V	Component: Controller
Illuminated key lights up, press key	●		Operation: Internal supply voltage
Operation in vehicle: Switch on ignition		If reading O.K., continue testing with next test step.	Malfunction: Voltage less than 4.7 V or greater than 5.25 V



- 1 = Spring
2 = Multiple plug (35-pin)
3 = Encoding block

Trouble-shooting:

Replace controller (switch off ignition).

Notes:

- Switch off ignition before disconnecting multiple plug.
- To disconnect multiple plug, press back spring, hinge up multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, make sure that multiple plug locks into spring.

E7

Test with ABS tester
Porsche 928 S

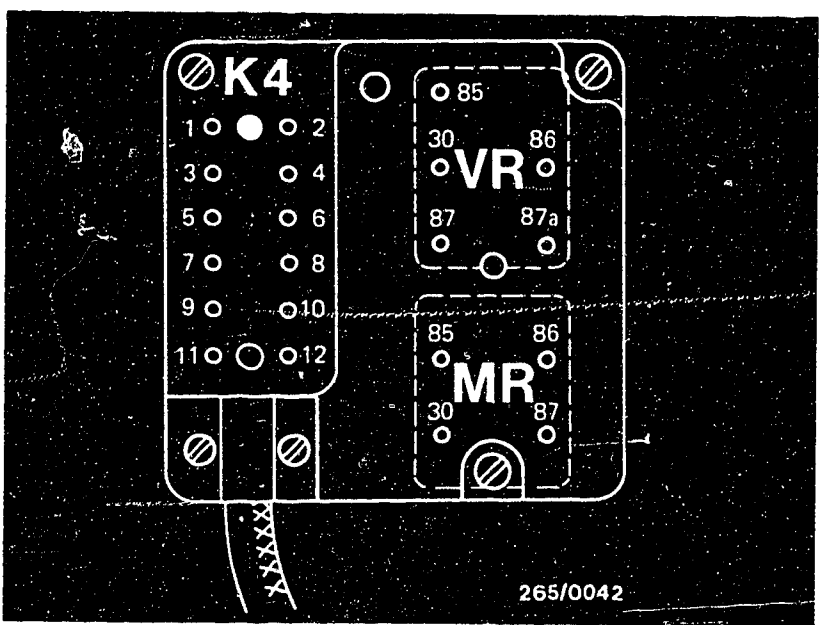


E8

Test with ABS tester
Porsche 928 S

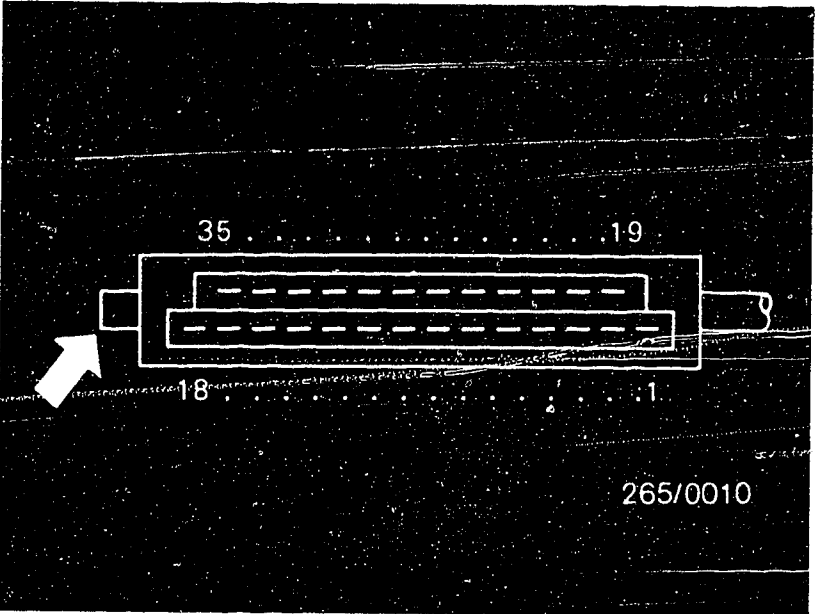


TEST STEP 18			
Operation:		Reading:	Testing:
Program-selector switch position	14	Digital display unit must indicate <u>0.4 ... 1.5 V</u>	Component: Hydraulic modulator and indicator lamp
Operation in vehicle: Switch on ignition		Check: ABS indicator lamp in vehicle must light up.	Operation: Diode in forward direction
		If reading O.K., continue testing with next test step.	Malfunction: Reading less than 0.4 or greater than 1.5 V. Indicator lamp does not light up.



Top view of plug-in plate of hydraulic modulator
 VR = Valve relay
 MR = Return-pump relay
 K4 = Wiring harness plug

Top view of multiple plug K1 (35-pin) with terminal numbers
 Arrow = Lug with mechanical plug



Trouble-shooting (switch off ignition): Indicator lamp not lit:

- Indicator lamp defective.
- Break in lead to ignition lock.
- Check for break in lead from multiple plug K1 (term. 29) to hydraulic modulator K 3/term. 7 as well as in lead to central information panel with central warning lamp term. 12. Check for brake in lead from central information panel term. 24 to instrument cluster term. 2.
- Using ohmmeter, check diode in forward and reverse directions between K4/term. 4 and K4/term. 7.

Reading not within tolerance

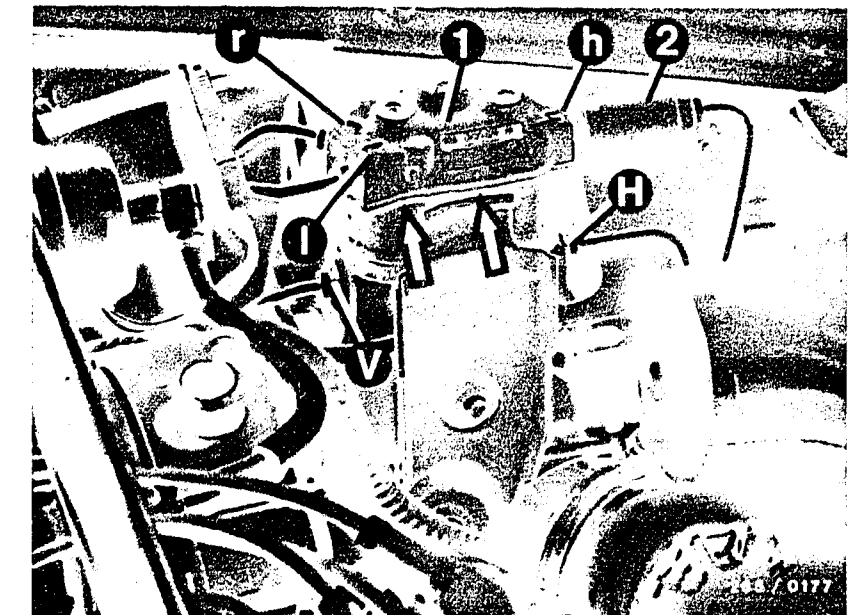
- Using ohmmeter, check diode in forward and reverse directions between K4/term. 4 and K4/term. 7.
- Check for break in lead between multiple plug K1/term. 29 and ABS indicator lamp. Lead is routed to instrument cluster term. 2 through central information panel term. 12 and term. 24.
- Check for voltage drop in plug-in connections at central information panel, instrument cluster, K3/term. 7, K4/term. 7, K3/term. 8, K4/term. 8 as well as ground lead and valve relay plug-in connections. If diode defective, replace hydraulic modulator.

Continued on E11/E12

Trouble-shooting for TEST STEP 18 (continued)

Important information on replacing the hydraulic modulator

- For safety reasons, the hydraulic modulator must not be repaired, but the complete unit must be replaced.
Exceptions to this are the return-pump relay and the valve relay. Both relays may be replaced.
- Apart from the brake line connections, it is not permissible to loosen any screws on the hydraulic modulator. Under no circumstances may the hexagon-socket-head cap screws/torx screws be loosened. After loosening, it is no longer possible to get the brake circuits leak-tight, or the brake circuits can no longer be bled.
Danger!
- Check the hydraulic modulator and brake-line connections for leaks by means of a visual examination. If brake fluid is escaping, tighten the brake-line connections (12 ... 16 Nm) or replace, or replace the hydraulic modulator.



1 = Hydraulic modulator
2 = Load-sensing valve
Arrows = Joints

Continued on E13/E14

E11

Test with ABS tester
Porsche 928 S



E12

Test with ABS tester
Porsche 928 S



Trouble-shooting for TEST STEP 18 (continued)

Pay particular attention to the joints identified by arrows (top picture). On the base of the hydraulic modulator there is a vent hole to the pump pistons. A slight escape of brake fluid at this point is possible.

A complaint is only justified if, after pressing the brake pedal several times, a pool of brake fluid is formed under the hydraulic modulator.

- When removing and installing the brake lines, make sure that the lines are marked in accordance with the markings on the hydraulic modulator and that they are not mixed up when re-connecting (e.g. the connection of the hydraulic modulator marked "L" must be connected to the front left wheel-brake cylinder).

• Markings on hydraulic modulator:

l = Connection for brake line front left (wheel-brake cylinder)
r = Connection for brake line front right (wheel-brake cylinder)
h = Connection for brake line of rear axle

V = Front axle brake circuit from brake master cylinder

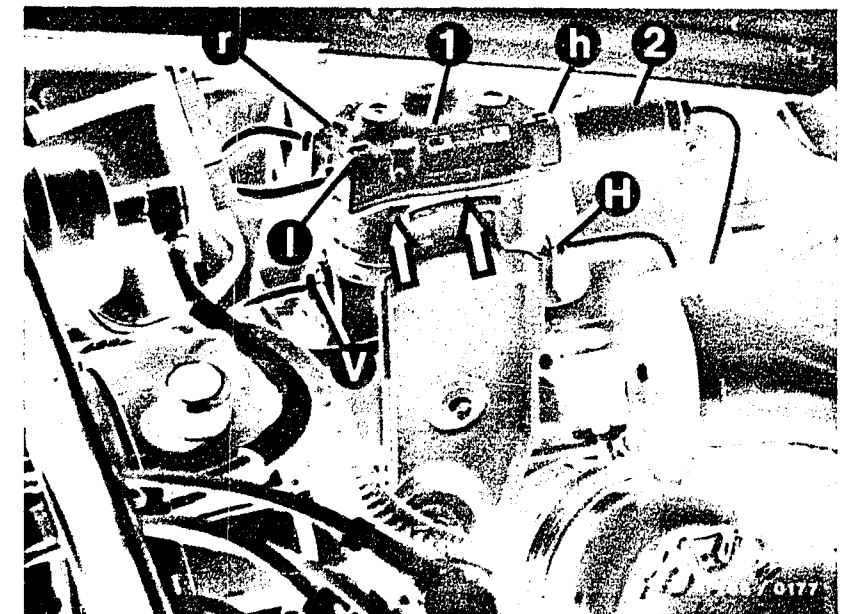
H = Rear axle brake circuit from brake master cylinder

- To remove, the left-hand front wheel must be taken off.

Removal

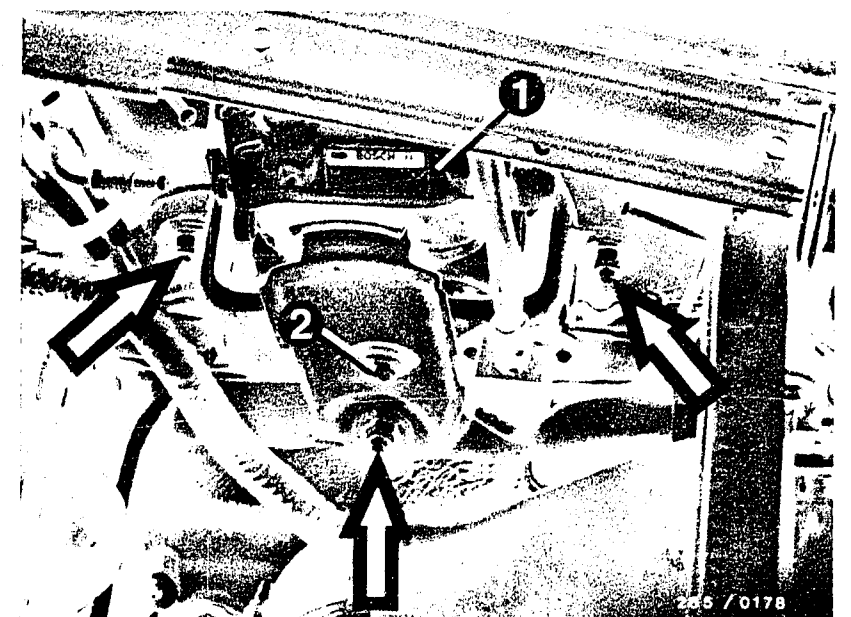
- Switch off ignition and loosen battery ground cable at bodywork.
- Remove left-hand connecting hose to air filter. Loosen supply reservoir for servo steering at bracket (leave hoses connected). Remove ignition cable from ignition coil.
- For loosening and tightening the brake lines, use only the specified double-head box wrench 9 x 11 mm.
- Mark brake lines and loosen from hydraulic modulator. Loosen load-sensing valve from hydraulic modulator.
- Catch brake fluid and do not bring into contact with hands or clothing or paintwork.
- Immediately seal brake lines and connections with dummy plugs.

Continued on E15/E16



1 = Hydraulic modulator
2 = Load-sensing valve
Arrows = Joints

1 = Hydraulic modulator
2 = Fastening screws
Arrows = Self-locking nuts



E13

Test with ABS tester
Porsche 928 S



E14

Test with ABS tester
Porsche 928 S

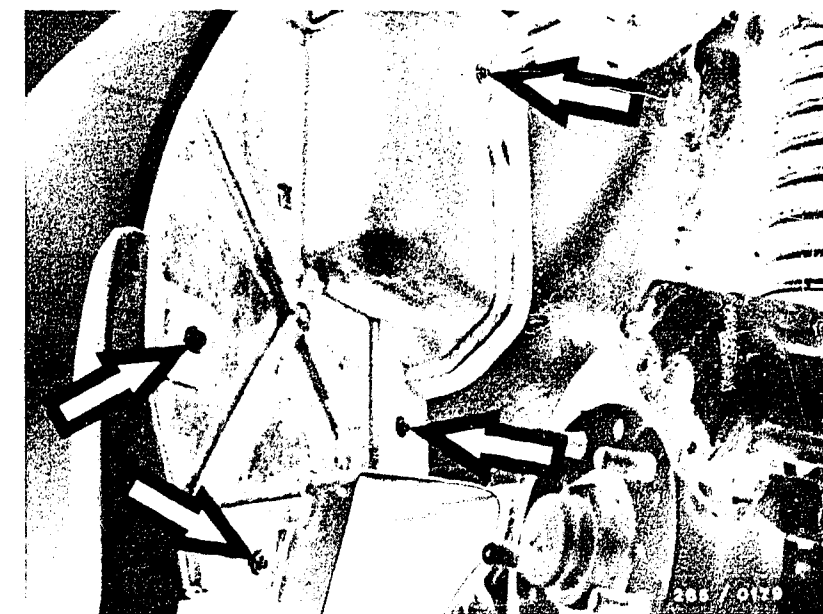


Trouble-shooting for TEST STEP 18 (continued)

- Loosen fastening screw for hydraulic modulator and self-locking nuts (3 pieces) from bracket.
- Take off left-hand front wheel.
- Unscrew wheelhouse seal.
- Unscrew hood from hydraulic modulator and take off.
- Loosen strain relief and take off plug.
- Loosen ground lead on pump motor.
- Loosen hexagon screws from bracket and take out hydraulic modulator

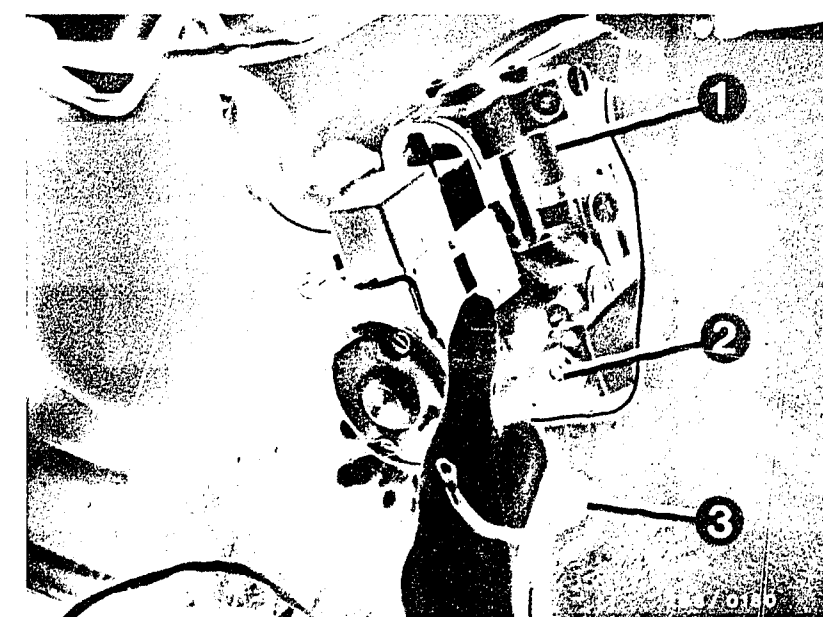
Installation

- Insert bracket for hydraulic modulator in wheelhouse and tilt downward on wheel side.
- Insert hydraulic modulator from wheel side into the bracket and screw in the 2 fastening screws, but do not tighten. Insert cable holder under the right-hand fastening screw.
- Secure bracket on wheel house with 3 self-locking nuts. If necessary, use new nuts.
- Mount hydraulic modulator in bracket. Tighten all 3 fastening screws.
- Connect ground lead to pump motor. Connect 12-pin plug and secure with strain relief.
- Mount hood with screw on hydraulic modulator
- Connect brake lines, in accordance with markings, as well as load-sensing valve to hydraulic modulator.
- Observe tightening torque for brake line connections on hydraulic modulator: 12 ... 16 Nm.
- Bleed brake system and check for leaks.
- Mount wheelhouse cover, front wheel, supply reservoir for servo steering, ignition cable on ignition coil and intake hose. Secure battery ground cable on body.
- Test ABS completely with tester.



Arrows = Fastening screws for wheel-house cover

- 1 = Hydraulic modulator
- 2 = Fastening point on bracket
- 3 = Ground lead from pump motor



E15

Test with ABS tester

Porsche 928 S



E16

Test with ABS tester

Porsche 928 S

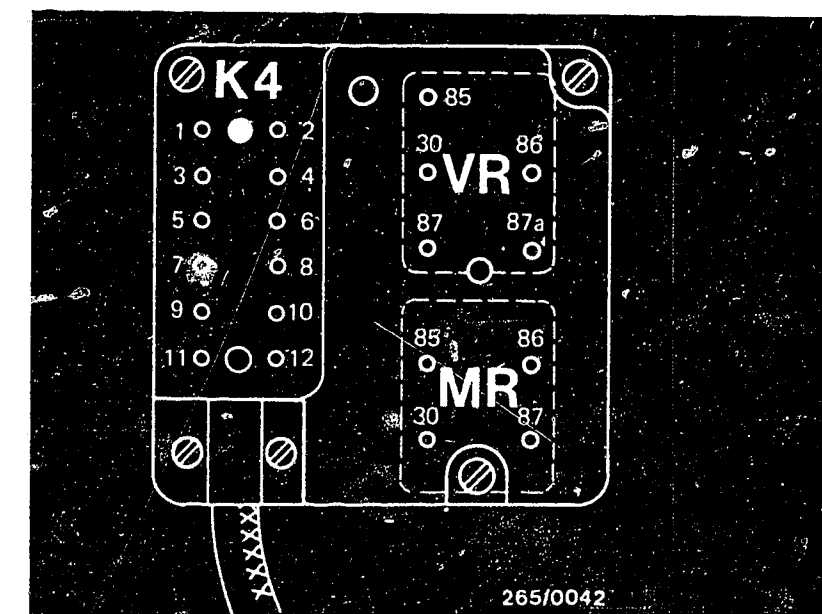


TEST STEP 19			
Operation:		Reading:	Testing:
Program-selector switch position	15	Digital display unit must indicate <u>2.5 ... 8.5 V</u>	Component: Hydraulic modulator
Operation in vehicle: Switch on ignition		Note: ABS indicator lamp slightly dimmer. Valve relay switches. If reading O.K., continue testing with next test step.	Operation: Diode in reverse direction
			Malfunction: Reading less than 2.5 V or greater than 8.5 V.

Trouble-shooting (switch off ignition):

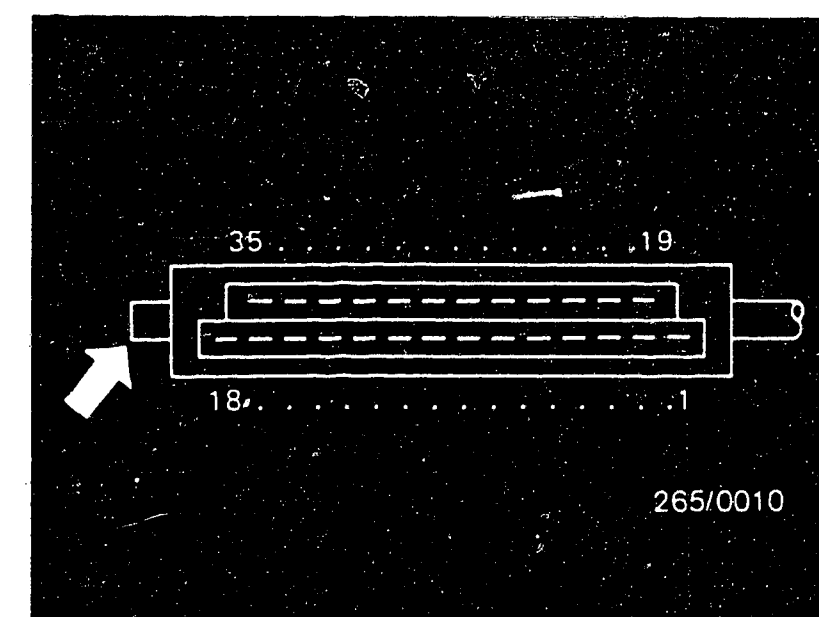
Reading outside tolerance:
Check diode in forward and reverse directions with ohmmeter between K4/term. 10 and K4/term. 12.
If diode defective, replace hydraulic modulator.

Continued on E19/E20



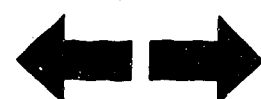
Top view of plug-in plate of hydraulic modulator
VR = Valve relay
MR = Return-pump relay
K4 = Wiring harness plug

Top view of multiple plug K1 (35-pin) with terminal numbers
Arrow = Lug with mechanical plug



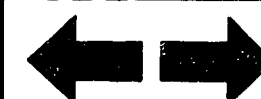
E17

Test with ABS tester
Porsche 928 S



E18

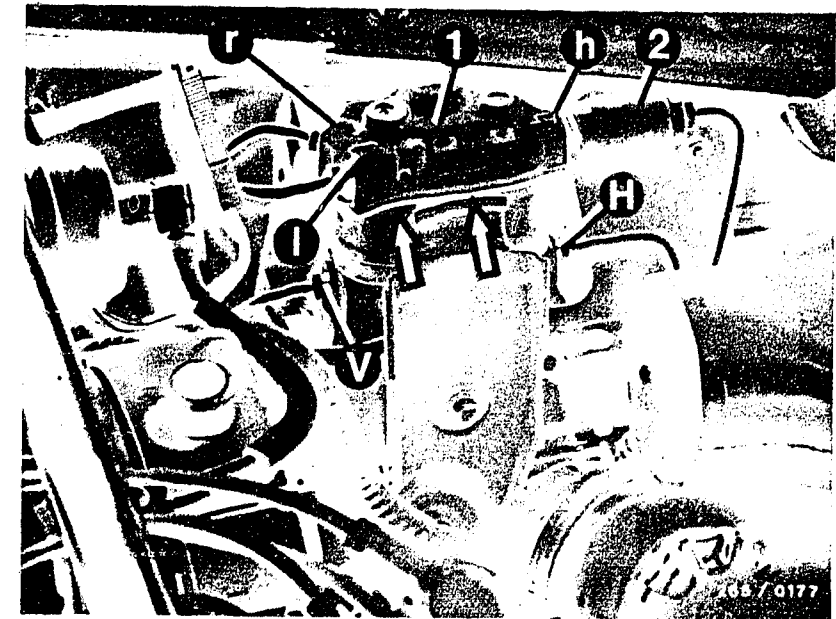
Test with ABS tester
Porsche 928 S



Trouble-shooting for TEST STEP 19 (continued)

Important information on replacing the hydraulic modulator

- For safety reasons, the hydraulic modulator must not be repaired, but the complete unit must be replaced.
Exceptions to this are the return-pump relay and the valve relay. Both relays may be replaced.
- Apart from the brake line connections, it is not permissible to loosen any screws on the hydraulic modulator. Under no circumstances may the hexagon-socket-head cap screws/torx screws be loosened. After loosening, it is no longer possible to get the brake circuits leak-tight, or the brake circuits can no longer be bled.
Danger!
- Check the hydraulic modulator and brake-line connections for leaks by means of a visual examination. If brake fluid is escaping, tighten the brake-line connections (12 ... 16 Nm) or replace, or replace the hydraulic modulator.



1 = Hydraulic modulator
2 = Load-sensing valve
Arrows = Joints

Continued on E21/E22

E19

Test with ABS tester
Porsche 928 S



E20

Test with ABS tester
Porsche 928 S



Trouble-shooting for TEST STEP 19 (continued)

Pay particular attention to the joints identified by arrows (top picture). On the base of the hydraulic modulator there is a vent hole to the pump pistons. A slight escape of brake fluid at this point is possible.

A complaint is only justified if, after pressing the brake pedal several times, a pool of brake fluid is formed under the hydraulic modulator.

- When removing and installing the brake lines, make sure that the lines are marked in accordance with the markings on the hydraulic modulator and that they are not mixed up when re-connecting (e.g. the connection of the hydraulic modulator marked "L" must be connected to the front left wheel-brake cylinder).

- Markings on hydraulic modulator:

l = Connection for brake line front left (wheel-brake cylinder)
r = Connection for brake line front right (wheel-brake cylinder)
h = Connection for brake line of rear axle

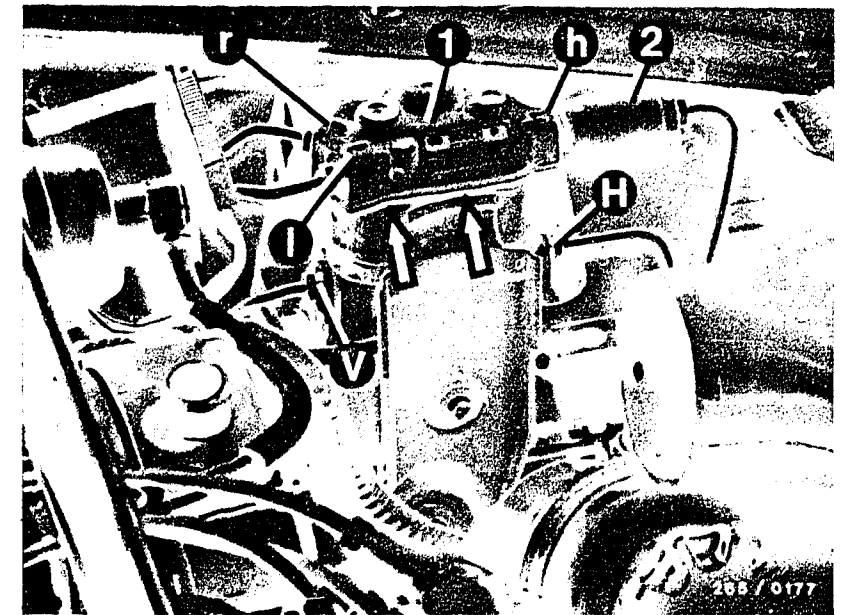
V = Front axle brake circuit from brake master cylinder
H = Rear axle brake circuit from brake master cylinder

- To remove, the left-hand front wheel must be taken off.

Removal

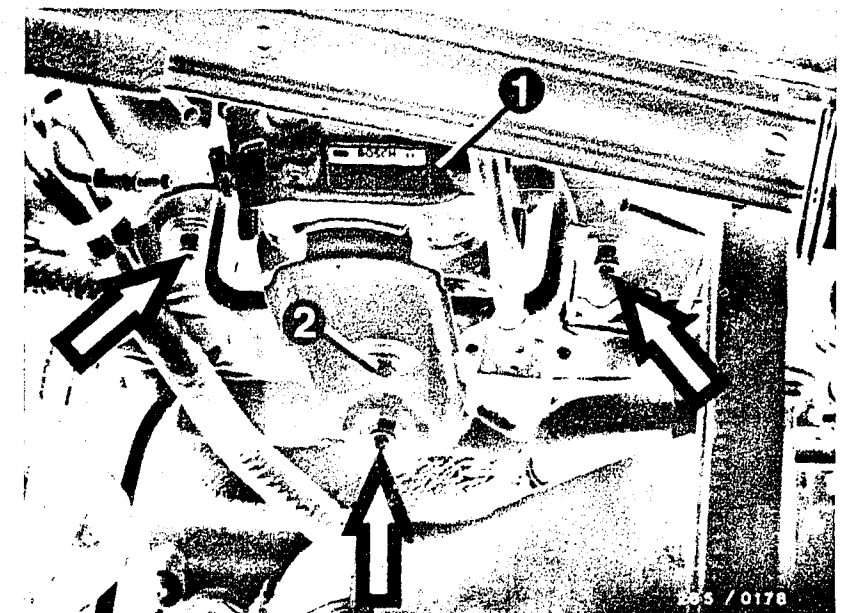
- Switch off ignition and loosen battery ground cable at bodywork.
- Remove left-hand connecting hose to air filter. Loosen supply reservoir for servo steering at bracket (leave hoses connected). Remove ignition cable from ignition coil.
- For loosening and tightening the brake lines, use only the specified double-head box wrench 9 x 11 mm.
- Mark brake lines and loosen from hydraulic modulator. Loosen load-sensing valve from hydraulic modulator.
- Catch brake fluid and do not bring into contact with hands or clothing or paintwork.
- Immediately seal brake lines and connections with dummy plugs.

Continued on E23/E24



1 = Hydraulic modulator
2 = Load-sensing valve
Arrows = Joints

1 = Hydraulic modulator
2 = Fastening screws
Arrows = Self-locking nuts



E21

Test with ABS tester

Porsche 928 S



E22

Test with ABS tester

Porsche 928 S

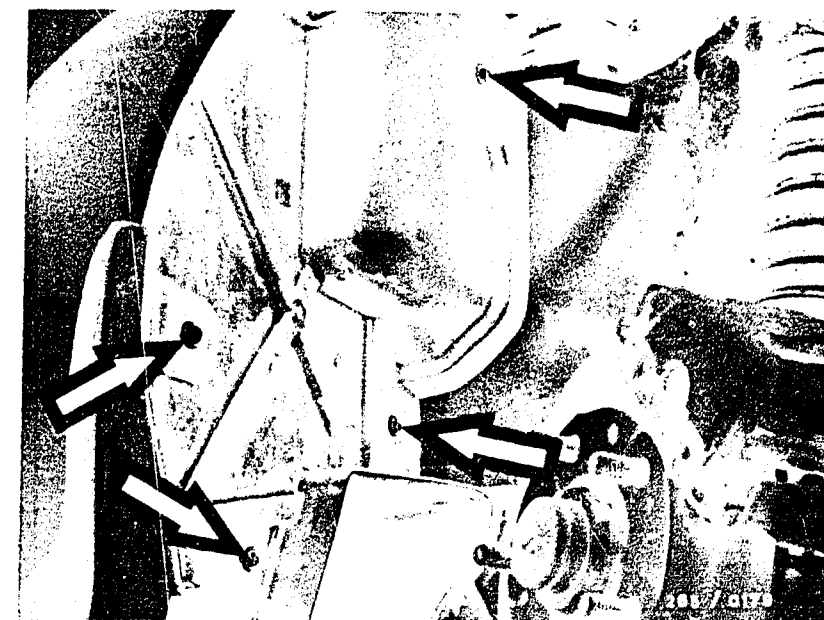


Trouble-shooting for TEST STEP 19 (continued)

- Loosen fastening screw for hydraulic modulator and self-locking nuts (3 pieces) from bracket.
- Take off left-hand front wheel.
- Unscrew wheelhouse seal.
- Unscrew hood from hydraulic modulator and take off.
- Loosen strain relief and take off plug.
- Loosen ground lead on pump motor.
- Loosen hexagon screws from bracket and take out hydraulic modulator

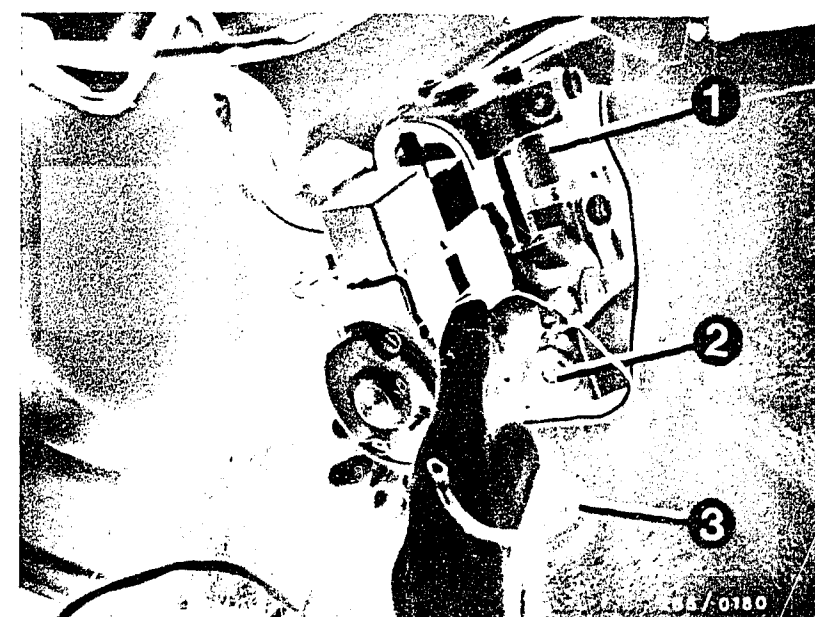
Installation

- Insert bracket for hydraulic modulator in wheelhouse and tilt downward on wheel side.
- Insert hydraulic modulator from wheel side into the bracket and screw in the 2 fastening screws, but do not tighten. Insert cable holder under the right-hand fastening screw.
- Secure bracket on wheel house with 3 self-locking nuts. If necessary, use new nuts.
- Mount hydraulic modulator in bracket. Tighten all 3 fastening screws.
- Connect ground lead to pump motor. Connect 12-pin plug and secure with strain relief.
- Mount hood with screw on hydraulic modulator
- Connect brake lines, in accordance with markings, as well as load-sensing valve to hydraulic modulator.
- Observe tightening torque for brake line connections on hydraulic modulator: 12 ... 16 Nm.
- Bleed brake system and check for leaks.
- Mount wheelhouse cover, front wheel, supply reservoir for servo steering, ignition cable on ignition coil and intake hose. Secure battery ground cable on body.
- Test ABS completely with tester.



Arrows = Fastening screws for wheel-house cover

- 1 = Hydraulic modulator
- 2 = Fastening point on bracket
- 3 = Ground lead from pump motor



E23

Test with ABS tester
Porsche 928 S

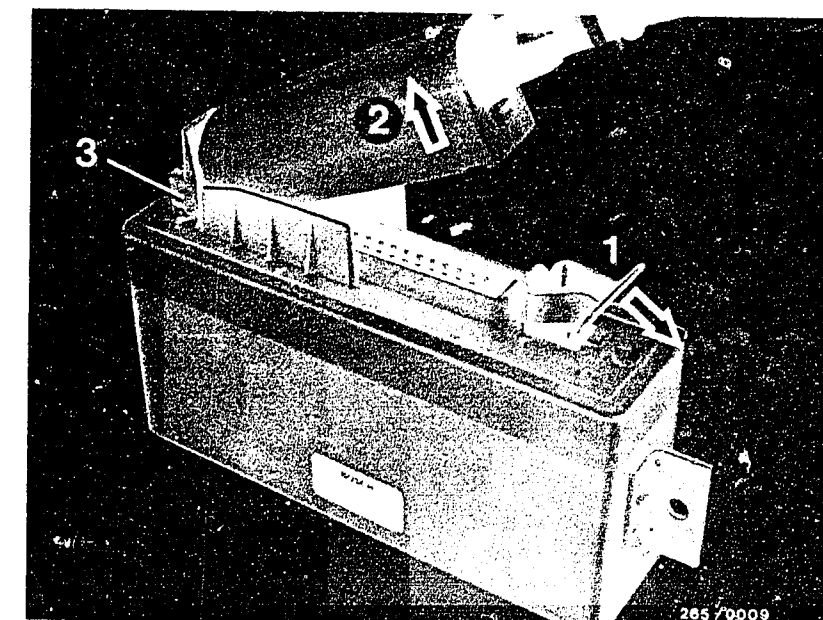


E24

Test with ABS tester
Porsche 928 S



TEST STEP 20			
<u>Operation:</u>		<u>Reading:</u>	<u>Testing:</u>
Program-selector switch position	16	Watch ABS indicator lamp in vehicle: After pressing the illuminated key the lamp must go out within 1 second	<u>Component:</u> Controller
Illuminated key lights up. Press key for at least 3 seconds.	●		<u>Operation:</u> BITE* triggering
<u>Operation in vehicle:</u> Switch off ignition			<u>Malfunction:</u> Indicator lamp does not go out



- 1 = Spring
 2 = Multiple plug (35-pin)
 3 = Encoding block

Trouble-shooting:

1. Repeat test step with engine running.
2. Replace controller (switch off ignition beforehand).

Notes:

- Switch off ignition before disconnecting multiple plug.
- To disconnect multiple plug, press back spring, hinge up multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, make sure that the multiple plug locks into the spring.

*BITE = Built-in test circuit

F1

Test with ABS tester
Porsche 928 S

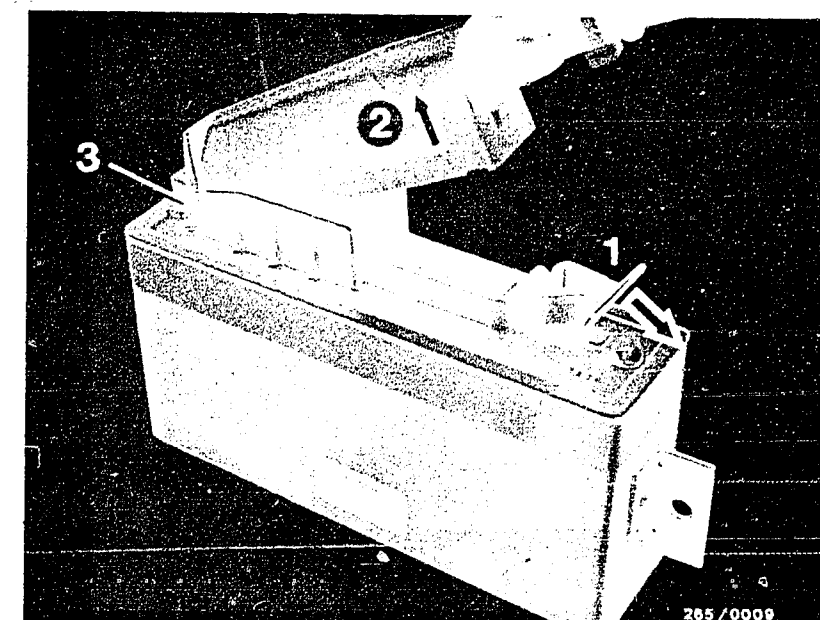


F2

Test with ABS tester
Porsche 928 S



TEST STEP 21			
<u>Operation:</u>		<u>Reading:</u>	<u>Testing:</u>
Program-selector switch position	17	Watch ABS indicator lamp in vehicle: <u>Lamp must light up as long as the key is pressed.</u> If reading O.K., <u>continue testing with next test step.</u>	<u>Component:</u> Controller
Illuminated key lights up. Press key for at least 3 seconds.	●		<u>Operation:</u> BITE* program with fault simulation
<u>Operation in vehicle:</u> Switch on ignition			<u>Malfunction:</u> Indicator lamp goes out.



- 1 = Spring
2 = Multiple plug (35-pin)
3 = Encoding block

Trouble-shooting:

1. Repeat test step with engine running.
2. Replace controller (switch off ignition beforehand).

Notes:

- Switch off ignition before disconnecting multiple plug.
- To disconnect multiple plug, press back spring, hinge up multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, make sure that the multiple plug locks into the spring.

*BITE = Built-in test circuit

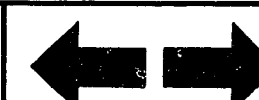
F3

Test with ABS tester
Porsche 928 S

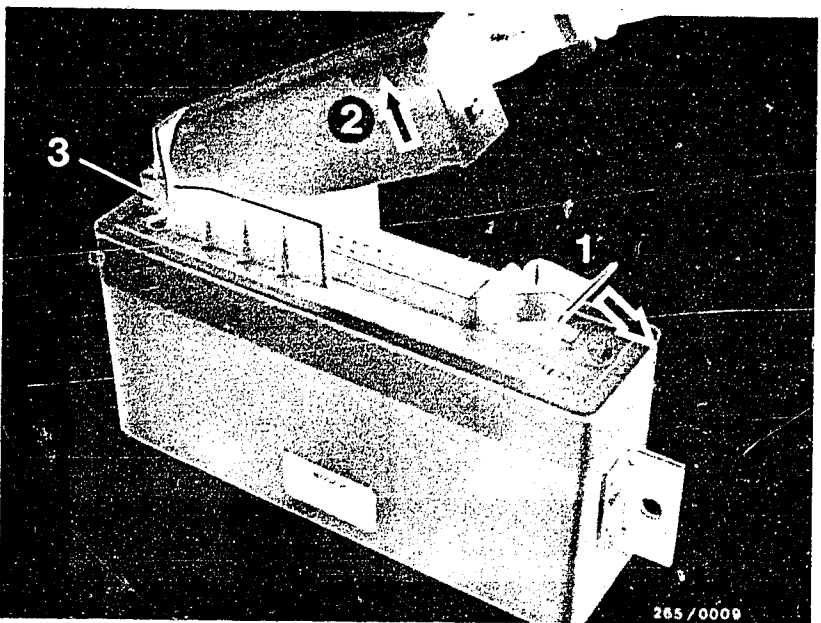


F4

Test with ABS tester
Porsche 928 S



TEST STEP 22			
<u>Operation:</u>		<u>Reading:</u>	<u>Testing:</u>
Program-selector switch position	18	Digital display unit must indicate <u>1.9 ... 2.3 A</u>	<u>Component:</u> Controller
Press key FL	●		
Illuminated key lights up. Press key. (Reading must be at zero before pressing the key).	●		<u>Operation:</u> Valve current. Pressure holding front left
<u>Operation in vehicle:</u> Switch on ignition		<u>Note:</u> Pump motor starts up. If reading OK, continue testing with next test step.	<u>Malfunction:</u> Current less than 1.9 A or greater than 2.3 A



- 1 = Spring
2 = Multiple plug (35-pin)
3 = Encoding block

Trouble-shooting:

1. Repeat test step with engine running.
2. Replace controller (switch off ignition beforehand):

Notes:

- Display jumps to zero after a few seconds.
If the test step is to be repeated, press the key again.
- Switch off the ignition before disconnecting the multiple plug.
- To disconnect the multiple plug, push back the spring, hinge up the multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, make sure that the multiple plug locks into the spring.

F5

Test with ABS tester
Porsche 928 S



F6

Test with ABS tester
Porsche 928 S



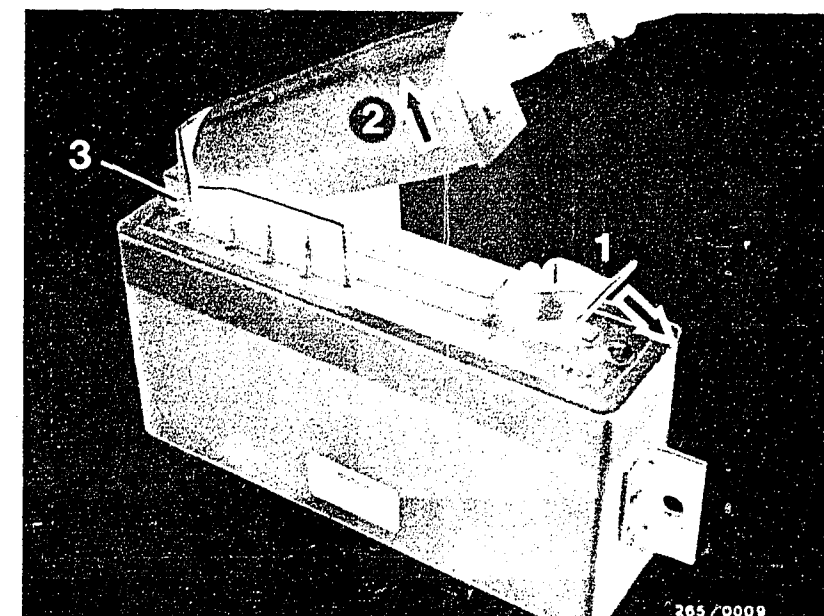
TEST STEP 23		Reading:	Testing:
Operation:			
Program-selector switch position	18	Digital display unit must indicate <u>1.9 ... 2.3 A</u>	Component: Controller
Press key FR	●		
Illuminated key lights up. Press key. (Reading must be at zero before pressing the key).	●	Note: Pump motor starts up. If reading O.K., continue testing with next test step.	Operation: Valve current. Pressure holding front right
Operation in vehicle: Switch on ignition			Malfunction: Current less than 1.9 A or greater than 2.3 A

Trouble-shooting:

1. Repeat test step with engine running.
2. Replace controller (switch off ignition beforehand).

Notes:

- Display jumps to zero after a few seconds.
If the test step is to be repeated, press the key again.
- Switch off the ignition before disconnecting the multiple plug.
- To disconnect the multiple plug, push back the spring, hinge up the multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, make sure that the multiple plug locks into the spring.



- 1 = Spring
- 2 = Multiple plug (35-pin)
- 3 = Encoding block

F7

Test with ABS tester
Porsche 928 S

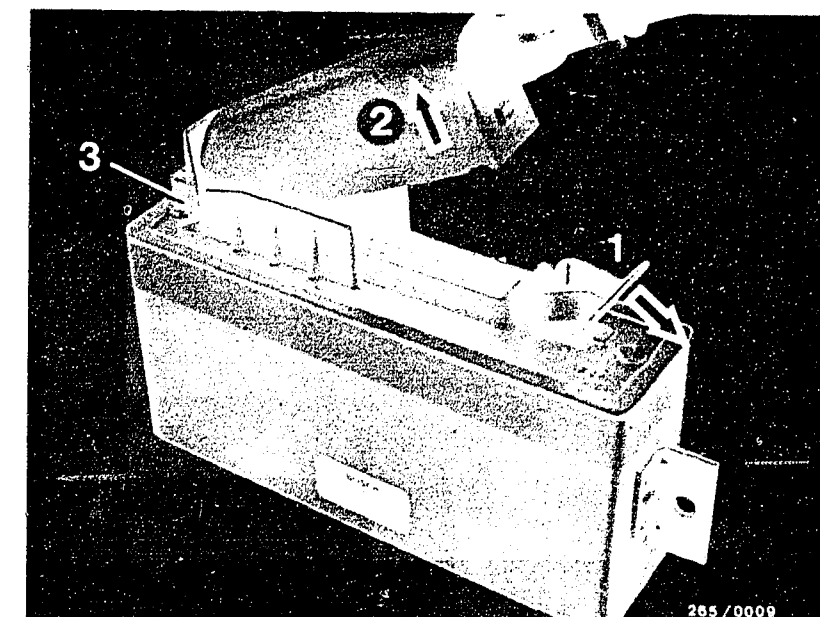


F8

Test with ABS tester
Porsche 928 S



TEST STEP 24			
Operation:		Reading:	Testing:
Program-selector switch program	18	Digital display unit must indicate <u>1.9 ... 2.3 A</u>	<u>Component:</u> Controller
Press key RA	●		<u>Operation:</u> Valve current. Pressure holding - rear axle
Illuminated key lights up. Press key. (Reading must be at zero before pressing the key).	●		<u>Malfunction:</u> Current less than 1.9 A or greater than 2.3 A
<u>Operation in vehicle:</u> Switch on ignition		<u>Note:</u> Pump motor starts up. If reading O.K., continue testing with <u>next test step.</u>	



- 1 = Spring
 2 = Multiple plug (35-pin)
 3 = Encoding block

Trouble-shooting:

1. Repeat test step with engine running.
2. Replace controller (switch off ignition beforehand).

Notes:

- Display jumps to zero after a few seconds.
If the test step is to be repeated, press the key again.
- Switch off the ignition before disconnecting the multiple plug.
- To disconnect the multiple plug, push back the spring, hinge up the multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, make sure that the multiple plug locks into the spring.

F9

Test with ABS tester
Porsche 928 S



F10

Test with ABS tester
Porsche 928 S



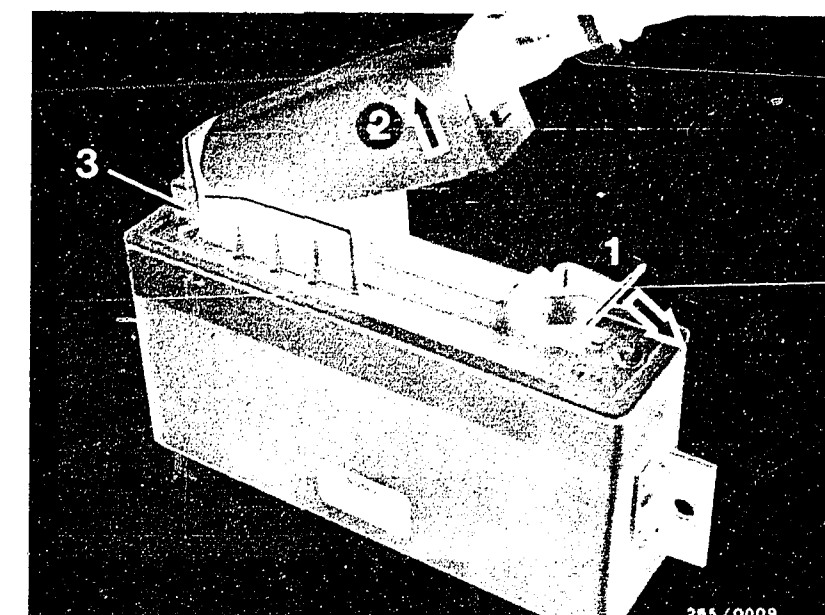
TEST STEP 25			
Operation:		Reading:	Testing:
Program-selector switch position	19	Digital display unit must indicate <u>4,5...6,0 A</u> Note: Pump motor starts up. If reading O.K., continue testing with next test step.	Component: Controller
Press key FL	●		Operation: Valve current, pressure reduction front left
Illuminated key lights up. Press key. (Reading must be at zero before pressing the key)	●		Malfunction: Current less than 4.5 A or greater than 6,0 A.
Operation in vehicle: Switch on ignition			

Trouble-shooting:

1. Repeat test step with engine running.
2. Replace controller (switch off ignition beforehand).

Notes:

- Display jumps to zero after a few seconds.
If the test step is to be repeated, press the key again.
- Switch off the ignition before disconnecting the multiple plug.
- To disconnect the multiple plug, push back the spring, hinge up the multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, make sure that the multiple plug locks into the spring.



- 1 = Spring
 2 = Multiple plug (35-pin)
 3 = Encoding block

F11

Test with ABS tester
Porsche 928 S



F12

Test with ABS tester
Porsche 928 S



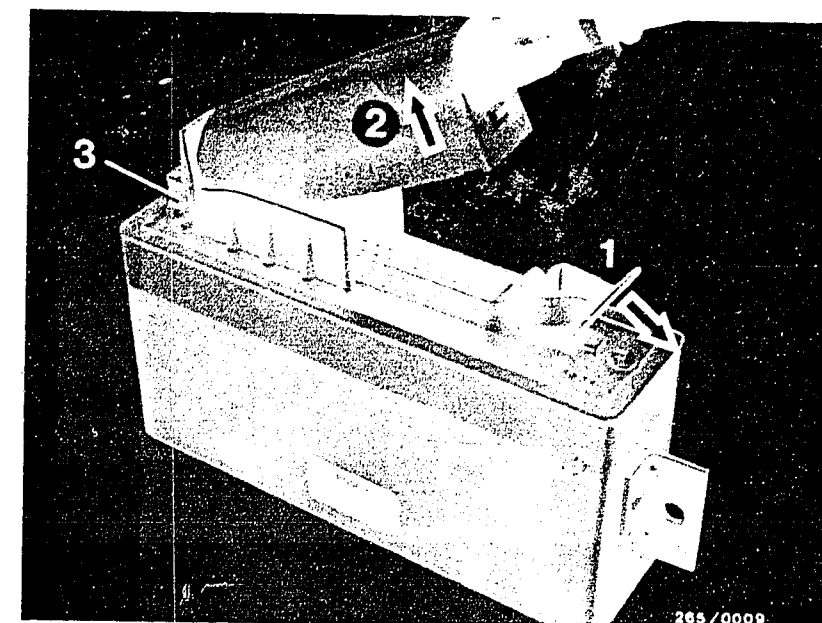
TEST STEP 26			
Operation:		Reading:	Testing:
Program-selector switch position	19	Digital display unit must indicate <u>4,5...6,0 A</u>	Component: Controller
Press key FR	●		Operation: Valve current, pressure reduction front right
Illuminated key lights up. Press key. (Reading must be at zero before pressing the key)	●		Malfunction: Current less than 4.5 A or greater than 6,0 A.
Operation in vehicle: Switch on ignition		Note: Pump motor starts up If reading O.K., continue testing with next test step.	

Trouble-shooting:

1. Repeat test step with engine running.
2. Replace controller (switch off ignition beforehand).

Notes:

- Display jumps to zero after a few seconds.
If the test step is to be repeated, press the key again.
- Switch off the ignition before disconnecting the multiple plug.
- To disconnect the multiple plug, push back the spring, hinge up the multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, make sure that the multiple plug locks into the spring.



- 1 = Spring
2 = Multiple plug (35-pin)
3 = Encoding block

F13

Test with ABS tester
Porsche 928 S

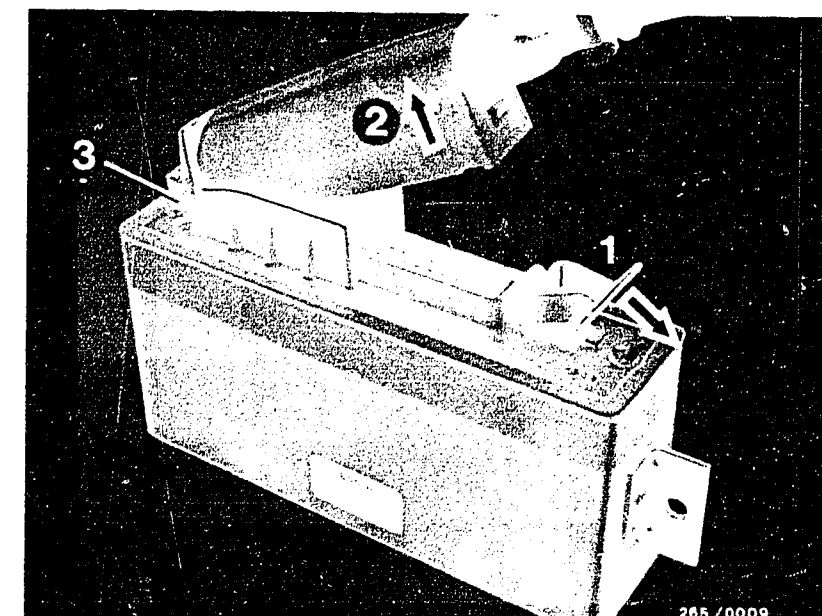


F14

Test with ABS tester
Porsche 928 S



TEST STEP 27			
Operation:		Reading:	Testing:
Program-selector switch position	19	Digital display unit must indicate <u>4.5 ... 6.0 A</u>	Component: Controller
Press key RA	●		
Illuminated key lights up. Press key. (Reading must be at zero before pressing the key)	●	Note: Pump motor starts up. If reading O.K., continue testing with next test step.	Operation: Valve current, pressure holding - rear axle
Operaiton in vehicle: Switch on ignition			Malfunction: Current less than 4.5 A or greater than 6.0 A.



- 1 = Spring
2 = Multiple plug (35-pin)
3 = Encoding block

Trouble-shooting:

1. Repeat test step with engine running.
2. Replace controller (switch off ignition beforehand).

Notes:

- Display jumps to zero after a few seconds.
If the test step is to be repeated, press the key again.
- Switch off the ignition before disconnecting the multiple plug.
- To disconnect the multiple plug, push back the spring, hinge up the multiple plug and unhook from encoding block.
- Install only the specified controller.
- When installing, make sure that the multiple plug locks into the spring.

F15

Test with ABS tester
Porsche 928 S

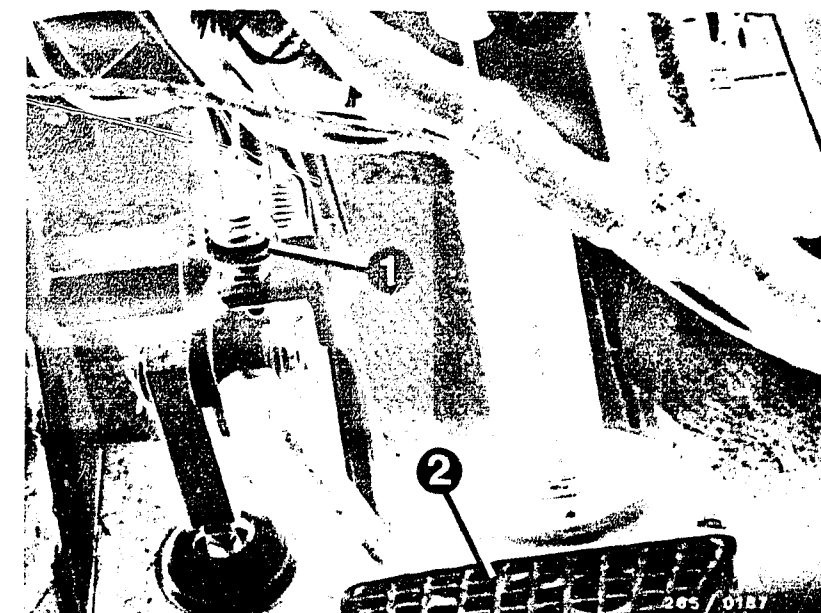


F16

Test with ABS tester
Porsche 928 S



TEST STEP 28		Reading:	Testing:
<u>Operation:</u> <div> <div>Program-selector switch position</div> <div>24</div> </div>	Digital display unit must indicate <u>10 ... 15 V</u> If reading O.K., continue testing with next test step.	<u>Component:</u> Stop-lamp switch	
<u>Operation in vehicle:</u> Switch on ignition. Press brake pedal.		<u>Operation:</u> Signal	
		<u>Malfunction:</u> Reading less than 10 V	
<u>Note:</u> Tester must be converted for generation 2B. <u>Trouble-shooting:</u> <u>No reading:</u> Check stop-lamp switch including plug connectors (Y2) and cables <u>Reading less than 10 V:</u> Stop lamps defective, eliminate contact resistances at plug connectors or replace stop-lamp switch.			



1 = Stop-lamp switch
2 = Brake pedal

Continued on F 19

A dynamic brake analyzer (DBA) is necessary for program-selector switch positions 20, 21, 22 and 23.

Caution:

Do not drive with the tester connected.

Do not use a brake-pedal actuating device for setting the brake-pedal force.

Bring test step - program switch position 23 - forward since the following test steps presuppose that the wheel-speed sensors are in good condition. When changing channels wait at least 20 seconds (internal tester program must have run).

Be sure to keep to the sequence of operations.

Start testing with front axle.

F19

Test with ABS tester

Porsche 928 S



TEST STEP 29		Reading:	Testing:
Operation:			
Program-selector switch position	23	Digital display unit must indicate <u>1.5 ... 19</u> In case of fluctuating readings, the lowest reading is valid. <u>Note:</u> If reading is 1.5, check air gap.	<u>Component:</u> Wheel-speed sensor <u>front left</u>
<u>Additional operations:</u> <ul style="list-style-type: none"> • Drive front wheels of vehicle onto dynamic brake analyzer • Pull on the handbrake. • Switch on the ignition. • Select wheel FL with key FL. • Switch on <u>left-hand brake roller</u>. • Make reading. 		<u>Operation:</u> Signal and mixing up of connecting cables	
		If reading O.K., continue testing with <u>next test step.</u>	<u>Malfunction:</u> Reading less than 1.5 or greater than 19

Trouble-shooting (switch off ignition)

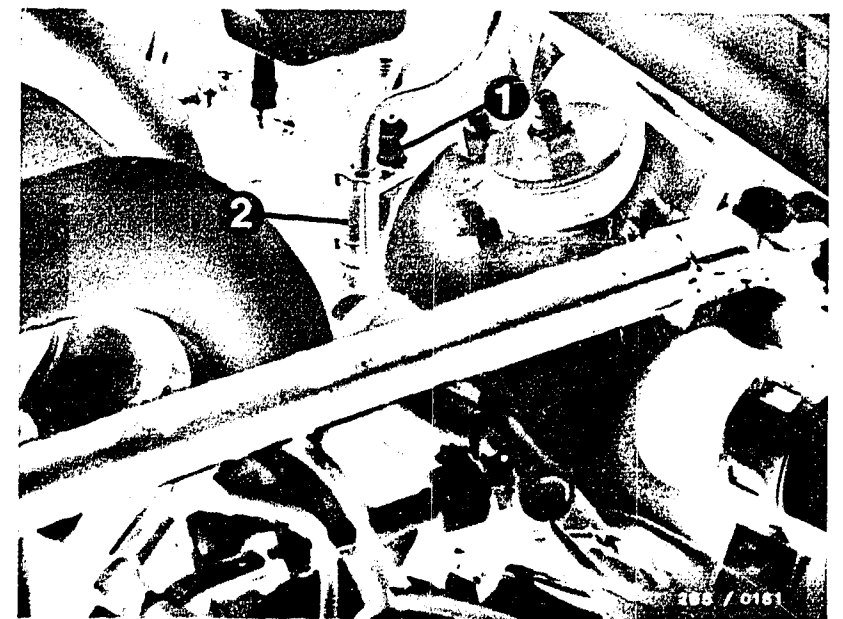
A reading of 999 signifies:

- Speed of dynamic brake analyzer too great (above approx. 13 km/h).

Reading 0 or less than 1.5

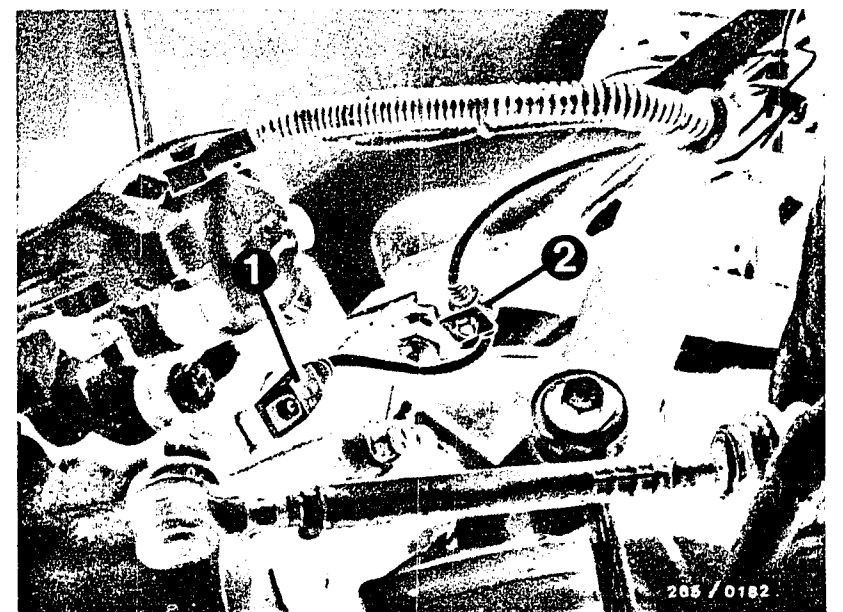
- Wheel-speed sensors mixed up? Check assignment: Wheel-speed sensors must be connected to the specified wheel and controller input (see circuit diagram).
- Air gap between wheel-speed sensor and ring gear too great. Check installation.
- Check wheel bearing play.
- Replace wheel-speed sensor.

Continued on F22/F23



- 1 = Wheel-speed sensor plug-in connector
- 2 = Plug-in connector for brake pad wear indicator

- 1 = Wheel-speed sensor
- 2 = Cable holder



F20

Test with ABS tester

Porsche 928 S



F21

Test with ABS tester

Porsche 928 S



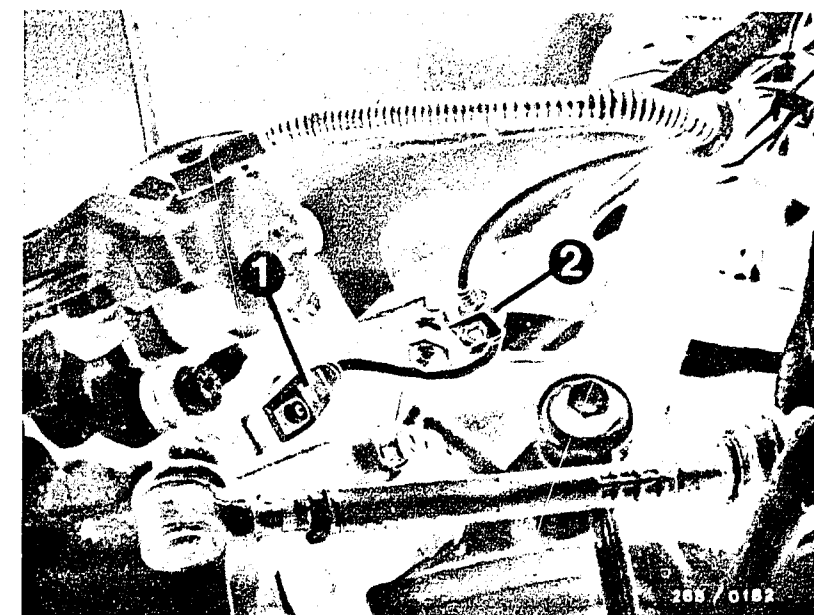
Trouble-shooting for TEST STEP 29 (continued)

Removing the wheel-speed sensors on the front axle

- Switch off ignition. Remove plug-in connector in engine compartment from holder and take apart.
- Unscrew front wheel. Remove intake hose to air filter and shielding plate of the front part of the exhaust system.
- Unclip wheel-speed sensor lead on wheelhouse and pull out with rubber grommet toward wheel side. At the same time, pull out rubber grommet of brake line.
- Unclip wheel-speed sensor lead on side member and on steering knuckle from the holders.
- Loosen hexagon-socket-head cap screw and carefully pull wheel-speed sensor out of the steering knuckle. Do not use force.

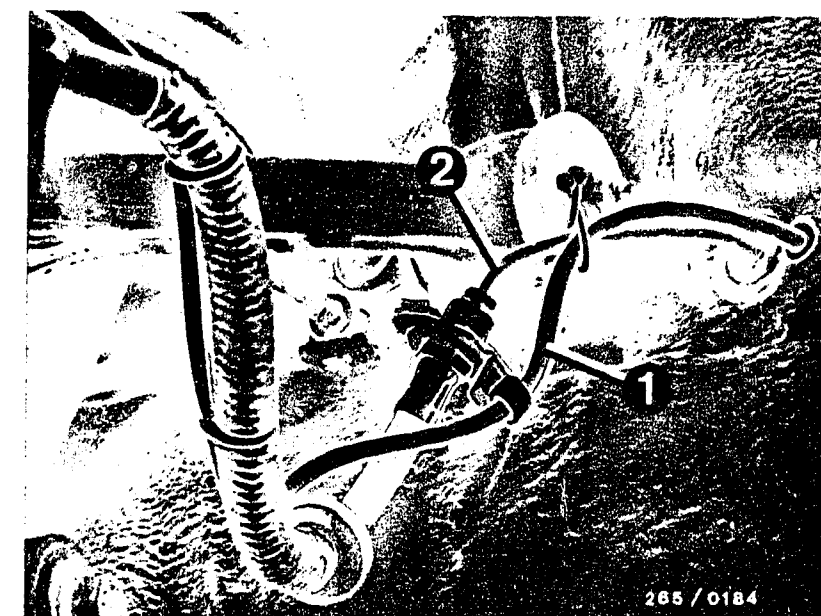
Install wheel-speed sensor on front axle.

- Check O-ring for cracks and replace if necessary.
- Only take new wheel-speed sensor out of protective sleeve when ready for mounting.
- Grease wheel-speed sensor housing lightly with Molykote Longterm 2.
- Make sure that no metallic foreign bodies are on the permanently magnetic edge.
- Carefully press wheel-speed sensor into mounting hole as far as it will go. Do not knock.
- Use new micro-encapsulated fastening screws.
Tighten fastening screws to 6...8 Nm
- Clip wheel-speed sensor lead into holders. Insert rubber grommets in holes.
- Connect wheel-speed sensor to ABS wiring harness and clip plug-in connector into holder.
- Mount exhaust system screening cover, intake hose and front wheel.
- After repairing, test with ABS tester.



1 = Wheel-speed sensor
2 = Cable holder

1 = Wheel-speed sensor lead
2 = Brake line



F22

Test with ABS tester
Porsche 928 S

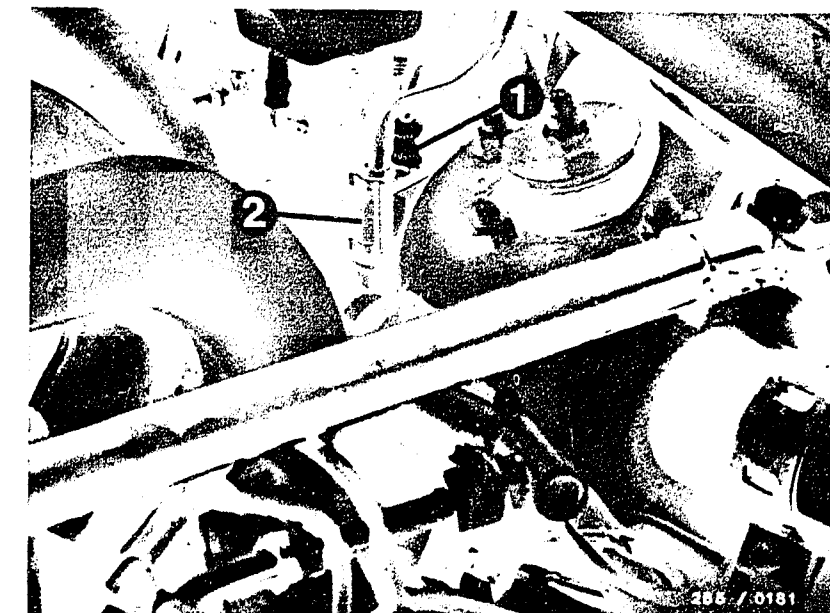


F23

Test with ABS tester
Porsche 928 S

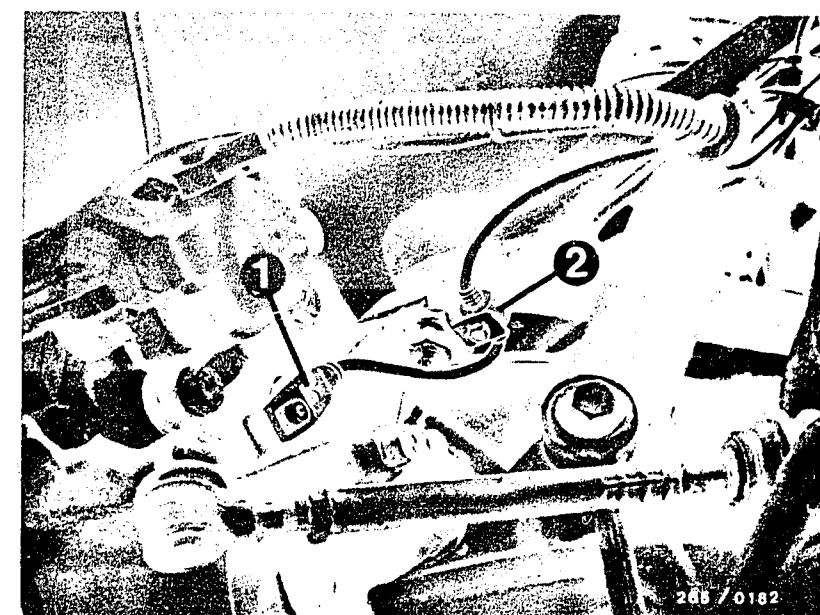


TEST STEP 30			
Operation:		Reading:	Testing:
Program-selector switch position	23	Digital display unit must indicate 1.5 ... 19	Component: Wheel-speed sensor <u>front right</u>
<u>Additional operations:</u> <ul style="list-style-type: none"> • Drive front wheels of vehicle onto dynamic brake analyzer • Pull on the handbrake. • Switch on the ignition. • Select wheel FR with key FR. • Switch on <u>left-hand brake roller</u>. • Make reading. 		<u>Operation:</u> Signal and mixing up of connecting cables	<u>Malfunction:</u> Reading less than 1.5 or greater than 19
		In case of fluctuating readings, the lowest reading is valid. <u>Note:</u> If reading is 1.5, check air gap. If reading O.K., continue testing with next test step.	



1 = Wheel-speed sensor plug-in connector
2 = Plug-in connector for brake pad wear indicator

1 = Wheel-speed sensor
2 = Cable holder



Trouble-shooting (switch off ignition)

A reading of 999 signifies:

- Speed of dynamic brake analyzer too great (above approx. 13 km/h).

Reading 0 or less than 1.5

- Wheel-speed sensors mixed up? Check assignment: Wheel-speed sensors must be connected to the specified wheel and controller input (see circuit diagram).
- Air gap between wheel-speed sensor and ring gear too great. Check installation.
- Check wheel bearing play.
- Replace wheel-speed sensor.

Continued on G3/G4

G1

Test with ABS tester
Porsche 928 S



G2

Test with ABS tester
Porsche 928 S



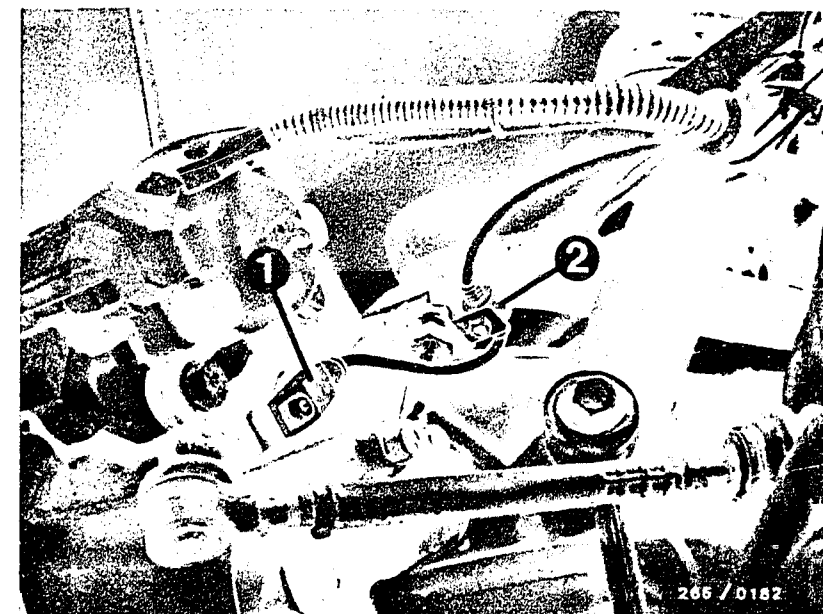
Trouble-shooting for TEST STEP 30 (continued)

Removing the wheel-speed sensors on the front axle

- Switch off ignition. Remove plug-in connector in engine compartment from holder and take apart.
- Unscrew front wheel. Remove intake hose to air filter and shielding plate of the front part of the exhaust system.
- Unclip wheel-speed sensor lead on wheelhouse and pull out with rubber grommet toward wheel side. At the same time, pull out rubber grommet of brake line.
- Unclip wheel-speed sensor lead on side member and on steering knuckle from the holders.
- Loosen hexagon-socket-head cap screw and carefully pull wheel-speed sensor out of the steering knuckle. Do not use force.

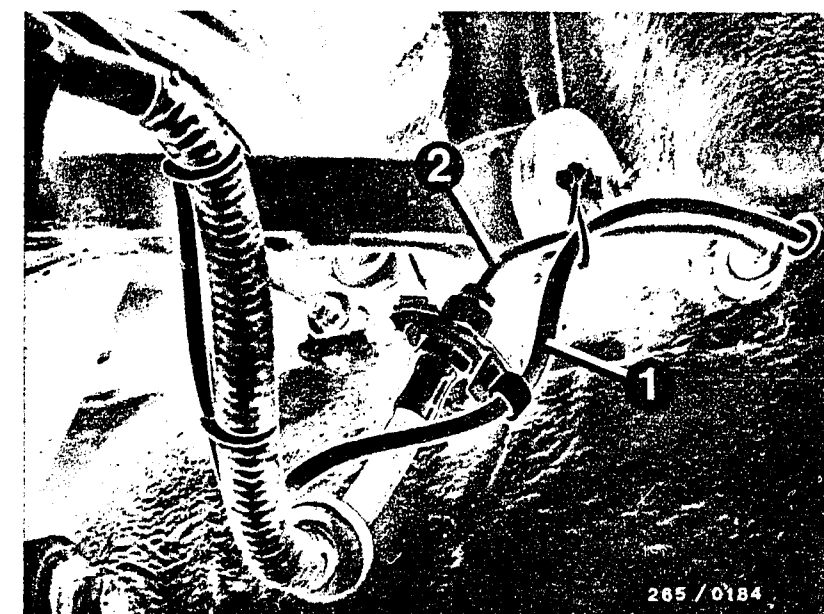
Install wheel-speed sensor on front axle.

- Check O-ring for cracks and replace if necessary.
- Only take new wheel-speed sensor out of protective sleeve when ready for mounting.
- Grease wheel-speed sensor housing lightly with Molykote Longterm 2.
- Make sure that no metallic foreign bodies are on the permanently magnetic edge.
- Carefully press wheel-speed sensor into mounting hole as far as it will go. Do not knock.
- Use new micro-encapsulated fastening screws.
Tighten fastening screws to 6...8 Nm
- Clip wheel-speed sensor lead into holders. Insert rubber grommets in holes.
- Connect wheel-speed sensor to ABS wiring harness and clip plug-in connector into holder.
- Mount exhaust system screening cover, intake hose and front wheel.
- After repairing, test with ABS tester.



1 = Wheel-speed sensor
2 = Cable holder

1 = Wheel-speed sensor lead
2 = Brake line



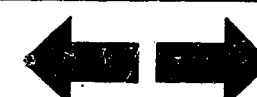
G3

Test with ABS tester
Porsche 928 S



G4

Test with ABS tester
Porsche 928 S



TEST STEP 31

Operation:

Program-selector switch position

20

Additional operations:

- Let the engine run.
- Select test step 20 and select wheel FL with key FL
- Switch on left-hand brake roller.
- Press brake pedal until the braking force reading on the dynamic brake analyzer is 2000 N (200 kgf).
- Press illuminated key.
- There must be a pressure reduction on the corresponding wheel (front left).
- Release the brake pedal and illuminated key (keep to the sequence of operations so that vehicle does not jump out of the rollers).

Reading:

Instruments on dynamic brake analyzer:

Left-hand reading drops to a value

below 1500 N (150 kgf)

If reading OK, continue testing with next test step.

Trouble-shooting:

- Lamp 2 (red) must not light up.
- Repeat test (possibly with engine stopped and without operation of brake booster)
- Brake lines on hydraulic modulator mixed up?
Note markings.
- Check assignment of brake roller to key FL once again.

Testing:

Component:

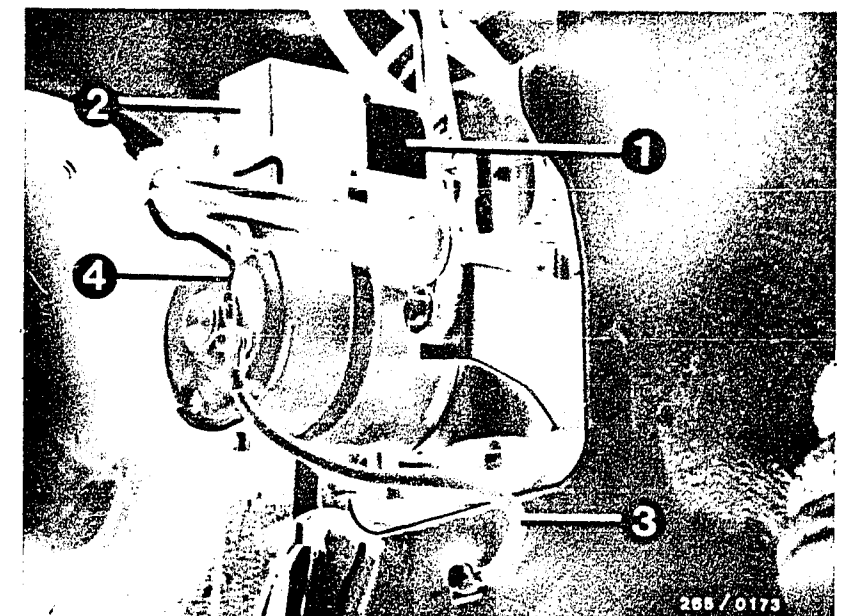
Hydraulic modulator, front axle

Operation:

Mixing up of brake lines

Malfunction:

Reading does not drop.



- 1 = Valve relay
- 2 = Return-pump relay
- l = Connection for brake line front left (wheel-brake cyl.)
- r = Connection for brake line front right (wheel-brake cyl.)
- h = Connection for brake line rear axle (wheel-brake cyl.)
- V = Brake line to brake master cylinder (brake circuit for front axle)
- H = Brake line to brake master cylinder (brake circuit for rear axle)

Caution

Under no circumstances may the hexagon-socket-head cap screws or the Torx screws be loosened. After loosening, the brake circuits can no longer be got free of leaks or can no longer be bled.

Danger!

G5

Test with ABS tester
Porsche 928 S



G6

Test with ABS tester
Porsche 928 S



TEST STEP 32

Operation:

Program-selector switch position

20

Additional operations:

- Let the engine run.
- Switch off left-hand brake roller.
- Switch on right-hand brake roller.
- Select wheel FR with key FR.
- Using brake pedal, produce braking force of 2000 N (200 kgf).
- Press illuminated key.
- There must be a pressure reduction on the corresponding wheel (front right).
- Release brake pedal and illuminated key.
(Follow the sequence of operations so that the vehicle does not jump out of the rollers).

Reading:

Instruments on dynamic brake analyzer:

Right-hand reading drops to a value

below 1500 N (150 kgf)

If reading O.K., continue testing with next test step.

Trouble-shooting:

- Lamp 2 (red) must not light up.
- Repeat test (possibly with engine stopped and without operation of brake booster)
- Brake lines on hydraulic modulator mixed up?
Note markings.
- Check assignment of brake roller to key FR once again.

Testing:

Component:

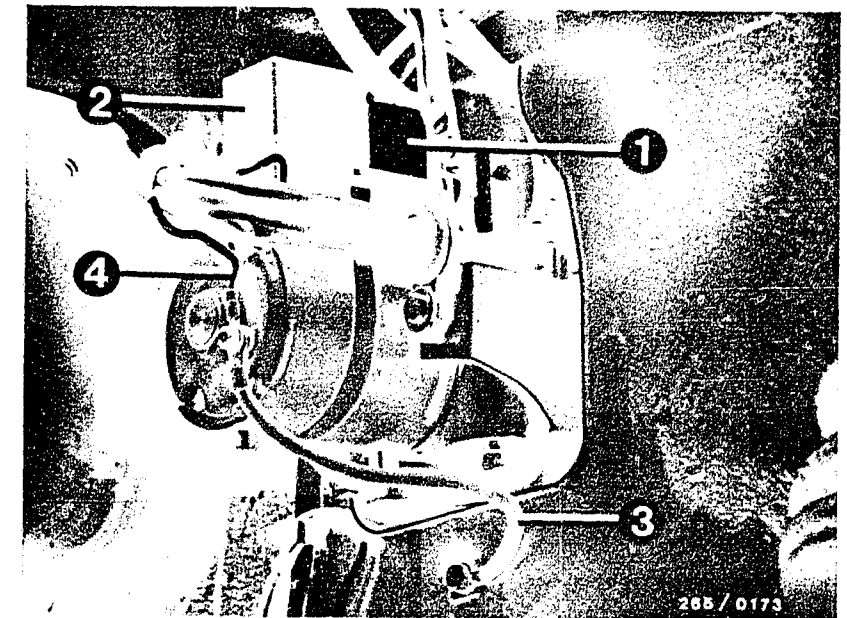
Hydraulic modulator, front axle

Operation:

Mixing up of brake lines

Malfunction:

Reading does not drop.



- 1 = Valve relay
- 2 = Return-pump relay
- l = Connection for brake line front left (wheel-brake cyl.)
- r = Connection for brake line front right (wheel-brake cyl.)
- h = Connection for brake line rear axle (wheel-brake cyl.)
- V = Brake line to brake master cylinder (brake circuit for front axle)
- H = Brake line to brake master cylinder (brake circuit for rear axle)

Caution

Under no circumstances may the hexagon-socket-head cap screws or the Torx screws be loosened. After loosening, the brake circuits can no longer be got free of leaks or can no longer be bled.

Danger!

G7

Test with ABS tester

Porsche 928 S



G8

Test with ABS tester

Porsche 928 S



TEST STEP 33

Operation:

Program-selector switch position

20

Additional operations:

- Let the engine run.
 - Switch on left-hand and right-hand brake rollers.
 - Select wheel FL with key FL.
 - Depress brake pedal until instrument on dynamic brake analyzer indicates 2000 N (200 kgf) for the left-hand side.
- Brake pedal force must not be changed throughout the entire testing procedure.
- Right-hand reading may differ by no more than 500 N (50 kgf) from the left-hand reading.
 - Press illuminated key until test is completed (approx. 10 seconds).
 - Read off left-hand reading.
 - Release brake pedal and illuminated key (follow the sequence of operations so that the vehicle does not jump out of the rollers).

Reading:

Instruments on dynamic brake analyzer:

Left-hand reading drops to a value

below 1500 N (150 kgf)

If reading OK, continue testing with next test step.

Trouble-shooting

- Lamp 2 (red) must not light up.
 - Repeat the test twice and make sure that the braking force is not changed during the testing procedure.
- Repeat test possibly with engine stopped and without operation of brake booster.

Continued on G 11

Testing:

Component:

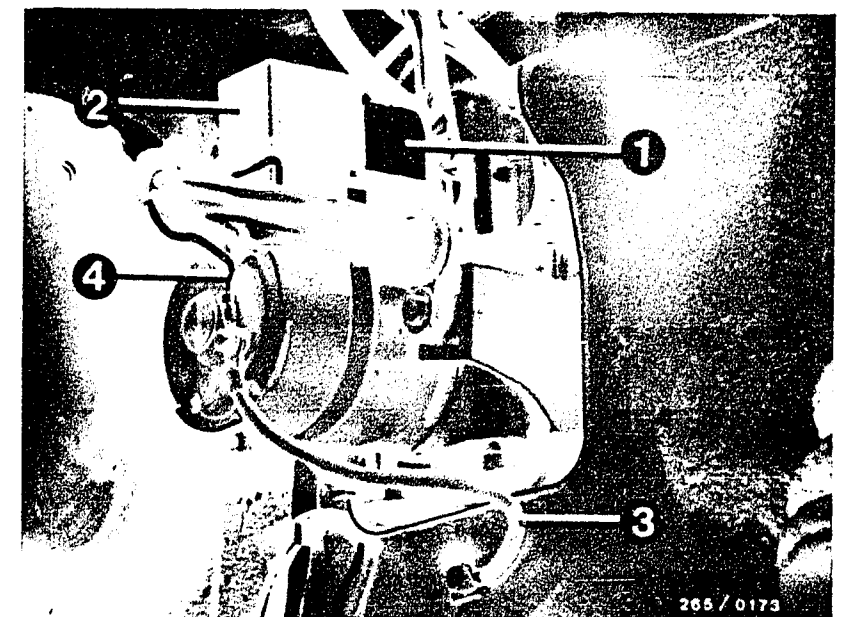
Hydraulic modulator

Operation:

Pressure reduction in brake lines front left.

Malfunction:

Braking force reading greater than 1500 N.



- 1 = Valve relay
- 2 = Return-pump relay
- l = Connection for brake line front left (wheel-brake cyl.)
- r = Connection for brake line front right (wheel-brake cyl.)
- h = Connection for brake line rear axle (wheel-brake cyl.)
- V = Brake line to brake master cylinder (brake circuit for front axle)
- H = Brake line to brake master cylinder (brake circuit for rear axle)

Caution

Under no circumstances may the hexagon-socket-head cap screws or the Torx screws be loosened. After loosening, the brake circuits can no longer be got free of leaks or can no longer be bled.

Danger!

G9

Test with ABS tester

Porsche 928 S



G10

Test with ABS tester

Porsche 928 S



TEST STEP 33

Trouble-shooting (continued)

- Rest of the brake system OK? Properly bled?
Brake-line connections not leaking? Brake pads OK?
Brake pads must not be "glazed". Brake discs OK?
Brake must "grip" well.
Brake master cylinder and wheel-brake cylinder OK?
Wheel-brake cylinder and brake pads must move freely.
Clean if necessary.
- Check ground terminals on pump motor and vehicle body.
- Check positive terminal on pump motor.
- Replace hydraulic modulator.

G11

Test with ABS tester

Porsche 928 S



TEST STEP 34

Operation:

Program-selector switch position

20

Additional operations:

- Let the engine run.
- Switch on both brake rollers.
- Select wheel FR with key FR.
- Press brake pedal until instrument on dynamic brake analyzer indicates 2000 N (200 kgf) for the right-hand side.
- Brake pedal force must not be changed throughout the entire testing procedure.
- Left-hand reading may differ by no more than 500 N (50 kgf) from the right-hand reading.
- Press illuminated key until test is completed (approx. 10 seconds).
- Read off right-hand reading.
- Release brake pedal and illuminated key (follow the sequence of operations so that the vehicle does not jump out of the rollers).

Reading:

Instruments on d
dynamic brake
analyzer:

Right-hand reading
drops to a value

below 1500 N (150 kgf)

If reading O.K., con-
tinue testing with
next test step.

Testing:

Component:

Hydraulic modulator

Operation:

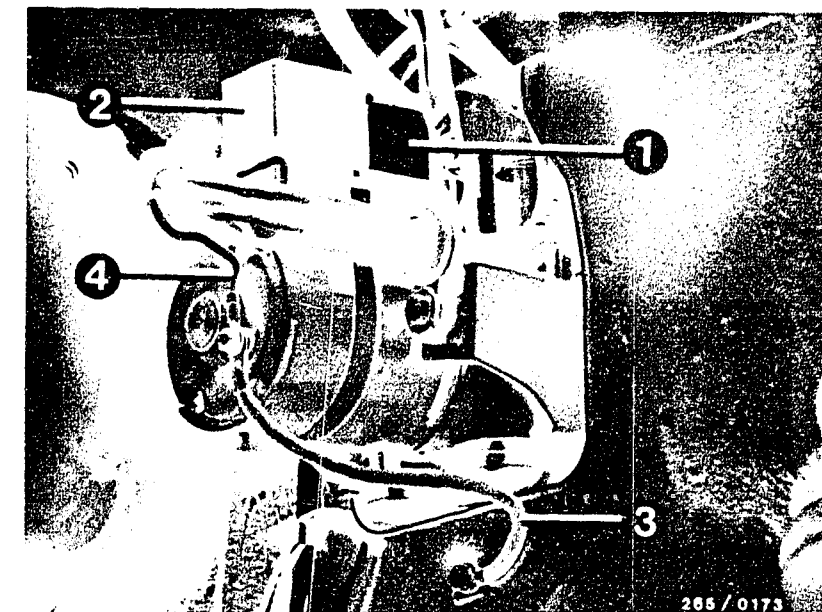
Pressure reduction in brake
lines front right

Malfunction:

Braking force reading greater
than 1500 N

Trouble-shooting

- Lamp 2 (red) must not light up.
 - Repeat the test twice and make sure that the braking force is not changed during the testing procedure.
- Repeat test possibly with engine stopped and without operation of brake booster.



- 1 = Valve relay
- 2 = Return-pump relay
- l = Connection for brake line front left (wheel-brake cyl.)
- r = Connection for brake line front right (wheel-brake cyl.)
- h = Connection for brake line rear axle (wheel-brake cyl.)
- V = Brake line to brake master cylinder (brake circuit for front axle)
- H = Brake line to brake master cylinder (brake circuit for rear axle)

Caution

Under no circumstances may the hexagon-socket-head cap screws or the Torx screws be loosened. After loosening, the brake circuits can no longer be got free of leaks or can no longer be bled.

Danger!

Continued on G 14

G12

Test with ABS tester
Porsche 928 S



G13

Test with ABS tester
Porsche 928 S



TEST STEP 34

Trouble-shooting (continued)

- Rest of the brake system OK? Properly bled?
Brake-line connections not leaking? Brake pads OK?
Brake pads must not be "glazed". Brake discs OK?
Brake must "grip" well.
Brake master cylinder and wheel-brake cylinder OK?
Wheel-brake cylinder and brake pads must move freely.
Clean if necessary.
- Check ground terminals on pump motor and vehicle body.
- Check positive terminal on pump motor.
- Replace hydraulic modulator.

G14

Test with ABS tester

Porsche 928 S



TEST STEP 35

Operation:

Program-selector switch position

21

Additional operations:

- Let the engine run.
- Switch on both brake rollers.
- Select wheel FL with key FL.
- Press brake pedal until instrument on dynamic brake analyzer indicates 2000 N (200 kgf) for the left-hand side.
- Brake pedal force must not be changed throughout the entire testing procedure.
- Press illuminated key continuously until test is completed (approx. 10 seconds)
- Read off left-hand reading.
- Release brake pedal and illuminated key (follow the sequence of operations so that the vehicle does not jump out of the rollers).

Reading:

Instruments on dynamic brake analyzer

Left-hand reading drops to an intermediate value and then rises to

max. 1700 N
(max. 170 kgf).

If reading O.K., continue testing with next test step.

Trouble-shooting

- Repeat the test twice and make sure that the braking force is not changed during the testing procedure.
Repeat test possibly with engine stopped and without operation of brake booster.

Continued on G 17

Testing:

Component:

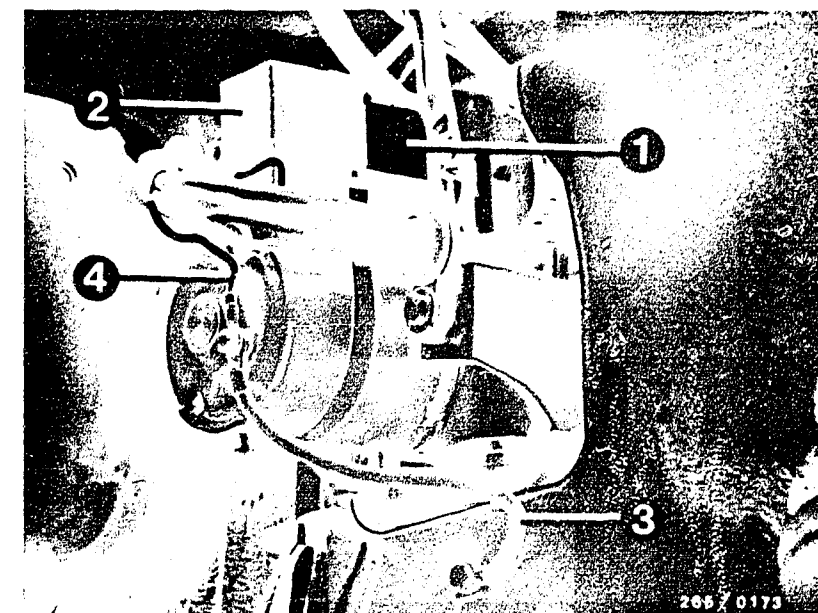
Hydraulic modulator

Operation:

Pressure buildup in brake lines front left

Malfunction:

Braking force reading greater than 1700 N



- 1 = Valve relay
- 2 = Return-pump relay
- l = Connection for brake line front left (wheel-brake cyl.)
- r = Connection for brake line front right (wheel-brake cyl.)
- h = Connection for brake line rear axle (wheel-brake cyl.)
- V = Brake line to brake master cylinder (brake circuit for front axle)
- H = Brake line to brake master cylinder (brake circuit for rear axle)

Caution

Under no circumstances may the hexagon-socket-head cap screws or the Torx screws be loosened. After loosening, the brake circuits can no longer be got free of leaks or can no longer be bled.

Danger!

G 15

Test with ABS tester
Porsche 928 S



G 16

Test with ABS tester
Porsche 928 S



TEST STEP 35

Trouble-shooting (continued)

- Rest of the brake system OK? Properly bled?
Brake-line connections not leaking? Brake pads OK?
Brake pads must not be "glazed". Brake discs OK?
Brake must "grip" well.
Brake master cylinder and wheel-brake cylinder OK?
Wheel-brake cylinder and brake pads must move freely.
Clean if necessary.
- Check ground terminals on pump motor and vehicle body.
- Check positive terminal on pump motor.
- Replace hydraulic modulator.



TEST STEP 36

Operation:

Program-selector switch position

21

Additional operations:

- Let the engine run.
- Switch on both brake rollers.
- Select wheel FR with key FR.
- Press brake pedal until instrument on dynamic brake analyzer indicates 2000 N (200 kgf) for the right-hand side.
- Brake pedal force must not be changed throughout the entire testing procedure.
- Press illuminated key continuously until test is completed (approx. 10 seconds)
- Read off right-hand reading.
- Release brake pedal and illuminated key (follow the sequence of operations so that the vehicle does not jump out of the rollers).

Reading:

Instruments on dynamic brake analyzer

Right-hand reading drops to an intermediate value and then rises to

max. 1700 N
(max. 170 kgf).

If reading O.K., continue testing with next test step.

Testing:

Component:

Hydraulic modulator

Operation:

Pressure buildup in brake lines front right

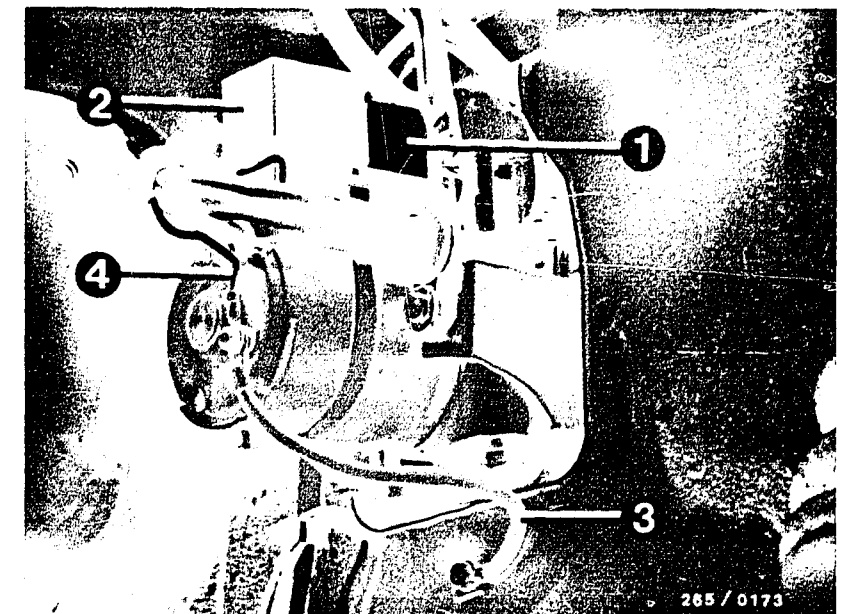
Malfunction:

Braking force reading greater than 1700 N.

Trouble-shooting

- Repeat the test twice and make sure that the braking force is not changed during the testing procedure.
Repeat test possibly with engine stopped and without operation of brake booster.

Continued on G 20



- 1 = Valve relay
- 2 = Return-pump relay
- l = Connection for brake line front left (wheel-brake cyl.)
- r = Connection for brake line front right (wheel-brake cyl.)
- h = Connection for brake line rear axle (wheel-brake cyl.)
- V = Brake line to brake master cylinder (brake circuit for front axle)
- H = Brake line to brake master cylinder (brake circuit for rear axle)

Caution

Under no circumstances may the hexagon-socket-head cap screws or the Torx screws be loosened. After loosening, the brake circuits can no longer be got free of leaks or can no longer be bled.

Danger!

G 18

Test with ABS tester

Porsche 928 S



G 19

Test with ABS tester

Porsche 928 S



TEST STEP 36

Trouble-shooting (continued)

- Rest of the brake system OK? Properly bled?
Brake-line connections not leaking? Brake pads OK?
Brake pads must not be "glazed". Brake discs OK?
Brake must "grip" well.
Brake master cylinder and wheel-brake cylinder OK?
Wheel-brake cylinder and brake pads must move freely.
Clean if necessary.
- Check ground terminals on pump motor and vehicle body.
- Check positive terminal on pump motor.
- Replace hydraulic modulator.

G20

Test with ABS tester

Porsche 928 S



TEST STEP 37

Operation:

Program-selector switch position

22

Additional operation:

- Let engine run.
- Switch on both brake rollers.
- Select wheel FL with key FL.
- Press brake pedal until instrument of dynamic analyzer indicates 2000 N (200 kgf) for left-hand side.
- Brake pedal force must not be changed throughout the entire test procedure.
- Press illuminated key until braking force rises again (after approx. 10 seconds).
- Read off left-hand reading.
- Release brake pedal and illuminated key (follow the sequence of operations so that the vehicle does not jump out of rollers).

Reading:

Instruments on dynamic brake analyzer:

After twice pressure reduction without return pump the pump is switched on briefly. Brake pedal comes back slightly when pump switches on. Then left-hand brake force reading must drop

below 600 N (60 kgf)

The test specification is indicated only for approx. 2.5 seconds and then rises again to the full braking force.

If reading O.K., continue testing with next test step.

Testing:

Component:

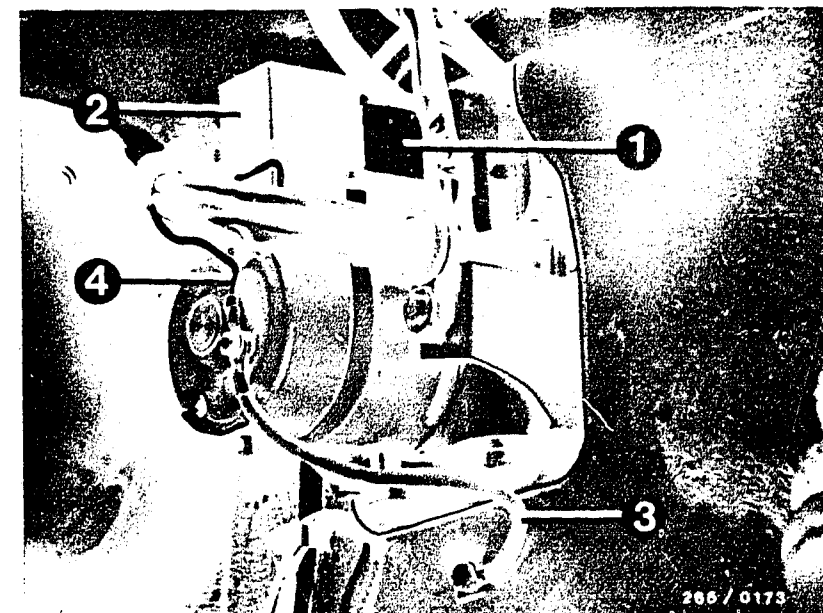
Hydraulic modulator

Operation:

Pump delivery
Front axle brake circuit

Malfunction:

Braking force reading greater than 600 N.



- 1 = Valve relay
- 2 = Return-pump relay
- l = Connection for brake line front left (wheel-brake cyl.)
- r = Connection for brake line front right (wheel-brake cyl.)
- h = Connection for brake line rear axle (wheel-brake cyl.)
- V = Brake line to brake master cylinder (brake circuit for front axle)
- H = Brake line to brake master cylinder (brake circuit for rear axle)

Caution

Under no circumstances may the hexagon-socket-head cap screws or the Torx screws be loosened. After loosening, the brake circuits can no longer be got free of leaks or can no longer be bled.

Danger!

Trouble-shooting:

- Repeat test twice and make sure that brake circuit is not changed during testing. Possibly repeat test with engine stopped and without operation of brake booster.

Continued on G23

G21

Test with ABS tester

Porsche 928 S



G22

Test with ABS tester

Porsche 928 S



TEST STEP 37

Trouble-shooting (continued)

- Rest of the brake system OK? Properly bled?
Brake-line connections not leaking? Brake pads OK?
Brake pads must not be "glazed". Brake discs OK?
Brake must "grip" well.
Brake master cylinder and wheel-brake cylinder OK?
Wheel-brake cylinder and brake pads must move freely.
Clean if necessary.
- Check ground terminals on pump motor and vehicle body.
- Check positive terminal on pump motor.
- Replace hydraulic modulator.



Rear axle - Carry out program-selector switch position 23 first since it is assumed for the following test steps that the wheel-speed sensors are in proper working order.

TEST STEP 38

Operation:

Program-selector switch position

23

Additional operations:

- Drive rear wheels of vehicle onto brake roller.
- Release handbrake.
- On vehicles with automatic transmission, set selector lever to position N.
- Switch on ignition.
- Select wheel RL with key RL
- Switch on left-hand brake roller.
- Take reading.

Reading:

Digital display unit must indicate

1.5 ... 19

In case of fluctuating readings, the lowest reading is valid.

Note:

If reading is 1.5, check air gap.

If reading O.K., continue testing with next test step.

Testing:

Component:

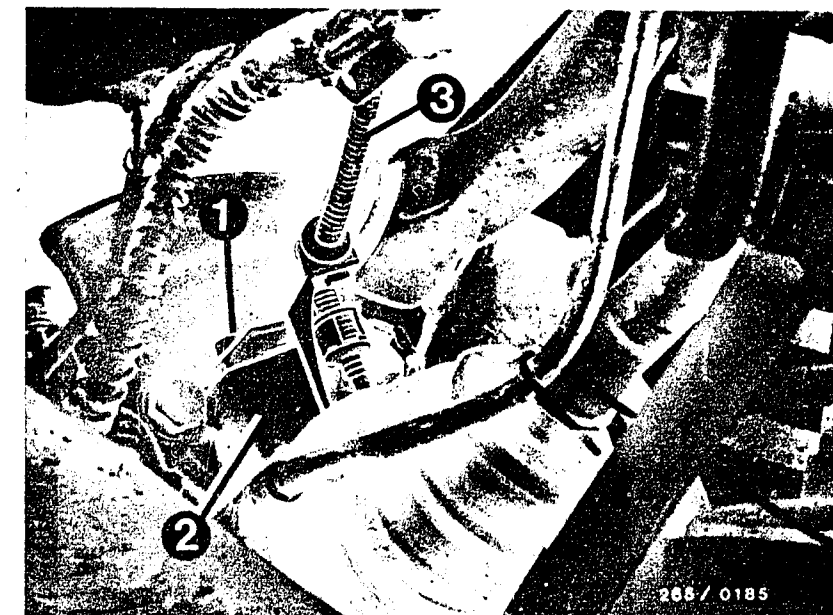
Rear left wheel-speed sensor

Operation:

Wheel-speed sensor signal

Malfunction:

Reading less than 1.5 or greater than 19

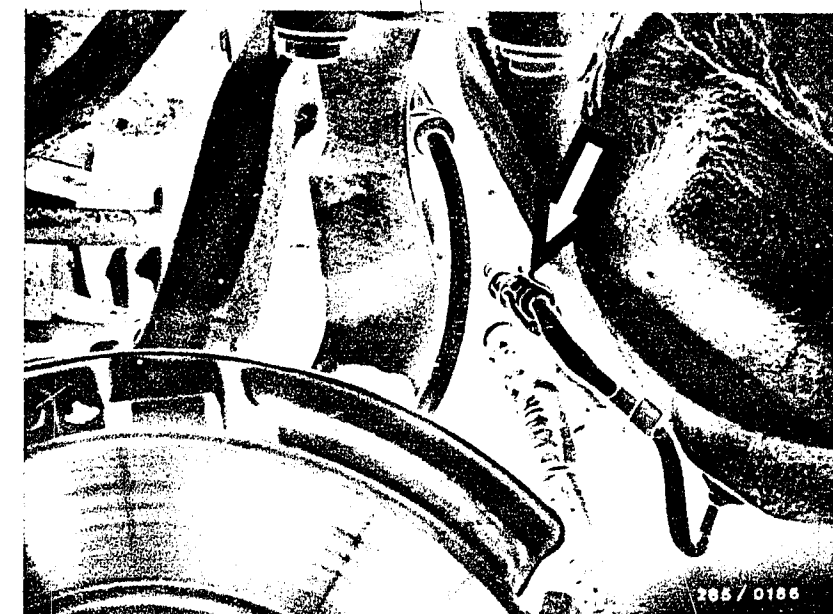


1 = Wheel-speed sensor

2 = Wheel carrier

3 = Wheel-speed sensor lead

Arrow = Wheel-speed sensor plug connector



Trouble-shooting (switch off ignition)

A reading of 999 signifies:

- Speed of dynamic brake analyzer too great (above approx. 13 km/h).

Reading 0 or less than 1.5

- Wheel-speed sensors mixed up? Check assignment: Wheel-speed sensors must be connected to the specified wheel and controller input (see circuit diagram).
- Air gap between wheel-speed sensor and ring gear too great. Check installation.
- Check wheel bearing play.
- Replace wheel-speed sensor.

Continued on H 3/H 4

H1

Test with ABS tester

Porsche 928 S



H2

Test with ABS tester

Porsche 928 S



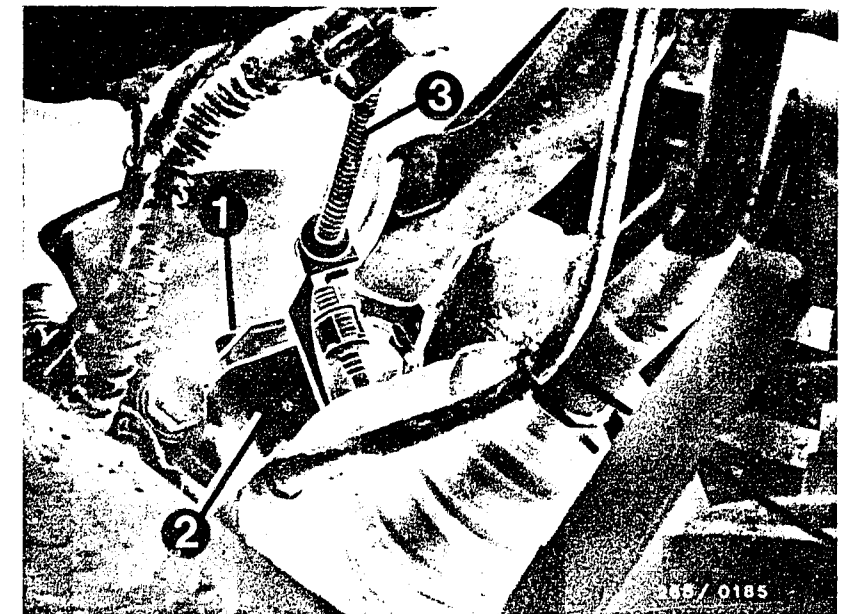
Trouble-shooting for TEST STEP 38 (continued)

Removing the wheel-speed sensors on the rear axle

- Unscrew the rear wheel.
- Switch off ignition. Take plug-in connector out of holder and take apart.
- Unclip wheel-speed sensor lead from rear-axle cross member and wheel carrier.
- Loosen hexagon-socket-head cap screw and carefully pull wheel-speed sensor out of wheel carrier. Do not use force.

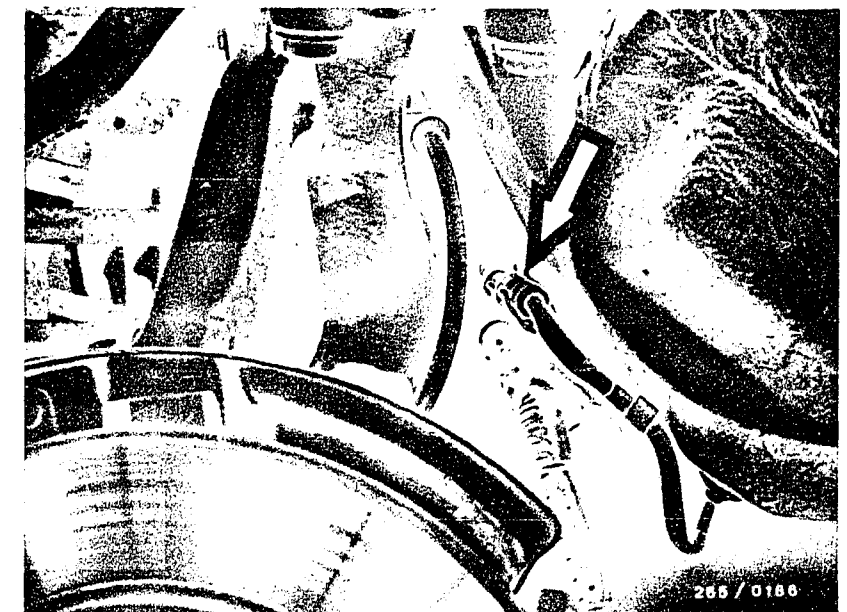
Installing the wheel-speed sensors on the rear axle

- Check O-ring for cracks and replace if necessary.
- Only take new wheel-speed sensor out of protective sleeve when ready for mounting.
- Grease wheel-speed sensor housing lightly with Molykote Longterm 2.
- Make sure that no metallic foreign bodies are on the permanently magnetic edge.
- Carefully press wheel-speed sensor into mounting hole as far as it will go. Do not knock.
- Use new micro-encapsulated fastening screw.
Tighten fastening screws to 6 ... 8 Nm.
- Clip wheel-speed sensor into the holders on wheel carrier and rear-axle member.
- Connect wheel-speed sensor to ABS wiring harness and clip plug connector into holder.
- Mount rear wheel.
- After repairing, perform test with ABS tester.



- 1 = Wheel-speed sensor
- 2 = Wheel carrier
- 3 = Wheel-speed sensor lead

Arrow = Wheel-speed sensor
plug connector



H3

Test with ABS tester
Porsche 928 S



H4

Test with ABS tester
Porsche 928 S



Rear axle - Carry out program-selector switch position 23 first since it is assumed for the following test steps that the wheel-speed sensors are in proper working order.

TEST STEP 39

Operation:

Program-selector switch position

23

Additional operations:

- Drive rear wheels of vehicle onto brake roller.
- Release handbrake.
- On vehicles with automatic transmission, set selector lever to position N.
- Switch on ignition.
- Select wheel RR with key RR
- Switch on left-hand brake roller.
- Take reading.

Reading:

Digital display unit must indicate

1.5 ... 19

In case of fluctuating readings, the lowest reading is valid.

Note:

If reading is 1.5, check air gap.

If reading O.K., continue testing with next test step.

Testing:

Component:

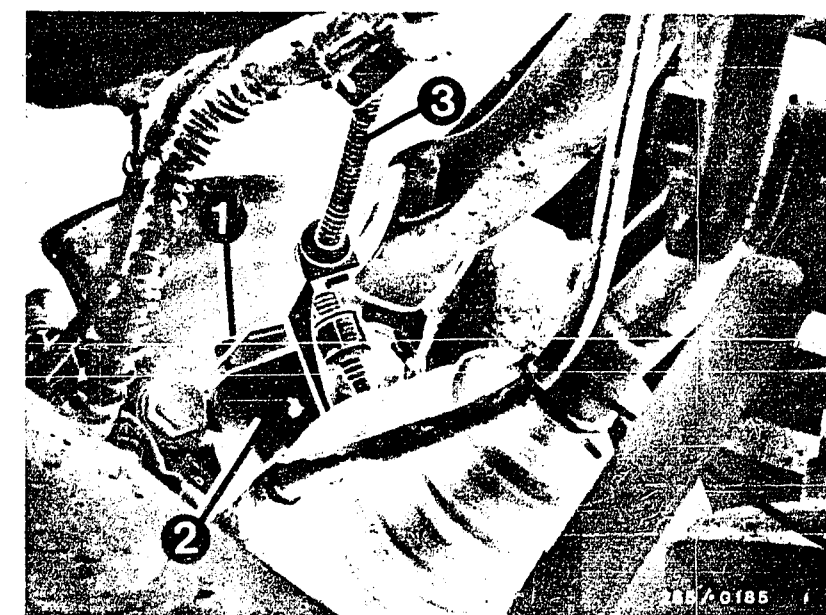
Rear right wheel-speed sensor

Operation:

Wheel-speed sensor signal

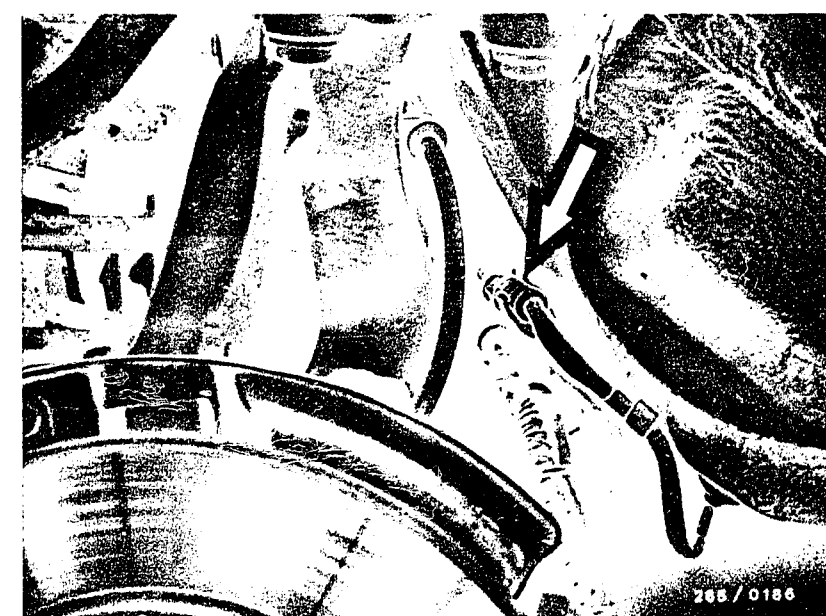
Malfunction:

Reading less than 1.5 or greater than 19



- 1 = Wheel-speed sensor
- 2 = Wheel carrier
- 3 = Wheel-speed sensor lead

Arrow = Wheel-speed sensor plug connector



Trouble-shooting (switch off ignition)

A reading of 999 signifies:

- Speed of dynamic brake analyzer too great (above approx. 13 km/h).

Reading 0 or less than 1.5

- Wheel-speed sensors mixed up? Check assignment: Wheel-speed sensors must be connected to the specified wheel and controller input (see circuit diagram).
- Air gap between wheel-speed sensor and ring gear too great. Check installation.
- Check wheel bearing play.
- Replace wheel-speed sensor.

Continued on H7/H8

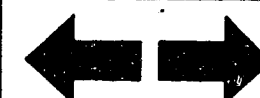
H5

Test with ABS tester
Porsche 928 S



H6

Test with ABS tester
Porsche 928 S



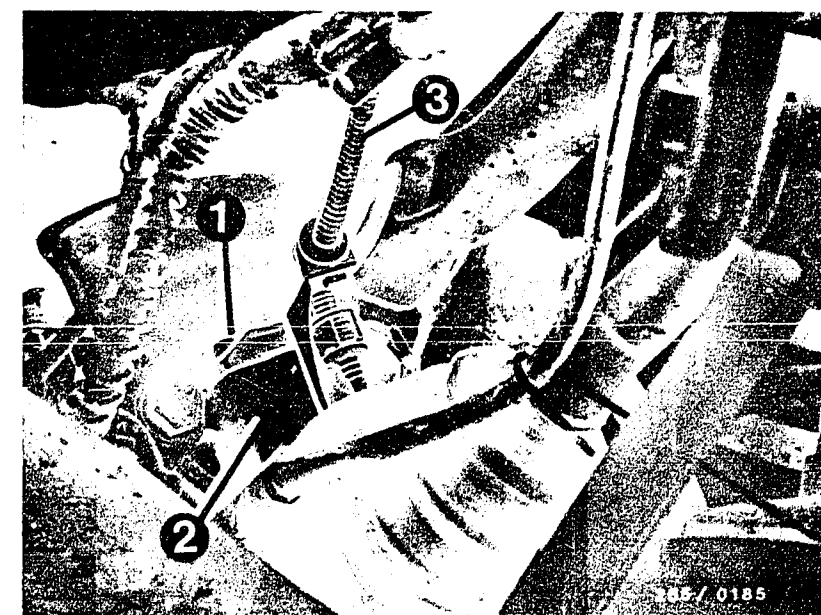
Trouble-shooting for TEST STEP 39 (continued)

Removing the wheel-speed sensors on the rear axle

- Unscrew the rear wheel.
- Switch off ignition. Take plug-in connector out of holder and take apart.
- Unclip wheel-speed sensor lead from rear-axle cross member and wheel carrier.
- Loosen hexagon-socket-head cap screw and carefully pull wheel-speed sensor out of wheel carrier. Do not use force.

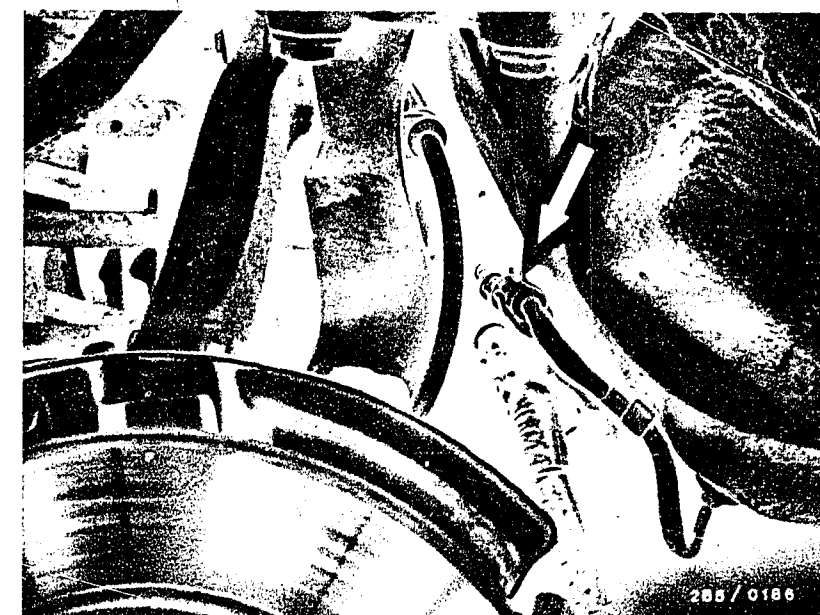
Installing the wheel-speed sensors on the rear axle

- Check O-ring for cracks and replace if necessary.
- Only take new wheel-speed sensor out of protective sleeve when ready for mounting.
- Grease wheel-speed sensor housing lightly with Molykote Longterm 2.
- Make sure that no metallic foreign bodies are on the permanently magnetic edge.
- Carefully press wheel-speed sensor into mounting hole as far as it will go. Do not knock.
- Use new micro-encapsulated fastening screw.
Tighten fastening screws to 6 ... 8 Nm.
- Clip wheel-speed sensor into the holders on wheel carrier and rear-axle member.
- Connect wheel-speed sensor to ABS wiring harness and clip plug connector into holder.
- Mount rear wheel.
- After repairing, perform test with ABS tester.



- 1 = Wheel-speed sensor
2 = Wheel carrier
3 = Wheel-speed sensor lead

Arrow = Wheel-speed sensor
plug connector



H7

Test with ABS tester
Porsche 928 S

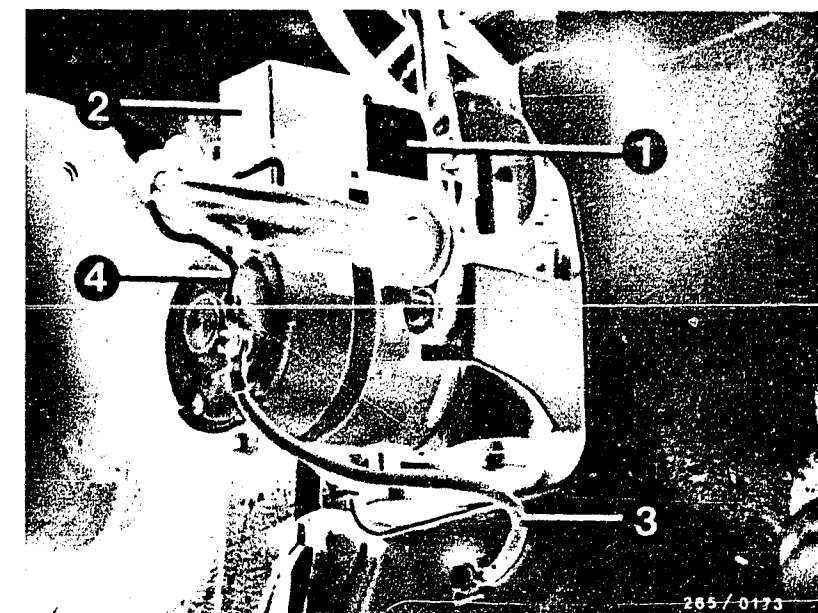


H8

Test with ABS tester
Porsche 928 S



TEST STEP 40		Reading:	Testing:
Operation:			
Program-selector switch position	20	Instruments of dynamic brake analyzer:	Component:
<u>Additional operation:</u> <ul style="list-style-type: none"> Let engine run. Select program switch position 20. Select rear axle with key RA. Switch on brake roller. Produce 2000 N (200 kgf) braking force with brake pedal. Press illuminated key. There must be pressure reduction on both wheels. Release brake pedal and illuminated key. (Follow sequence of operations so that vehicle does not jump out of rollers).		<u>Left-hand and right hand reading moves to a value below 1500 N (150 kgf)</u>	Hydraulic modulator, rear axle
		If reading O.K. continue testing with next test step.	<u>Operation:</u> Mixing up of brake lines
			<u>Malfuntion:</u> Reading does not drop
		<u>Trouble-shooting:</u> <ul style="list-style-type: none"> Lamp 2 (red) must not light up. Repeat test. Brake lines mixed up on hydraulic modulator? Follow markings. Correct key (RA) pressed? Replace hydraulic modulator. 	



- 1 = Valve relay
- 2 = Return-pump relay
- l = Connection for brake line front left (wheel-brake cyl.)
- r = Connection for brake line front right (wheel-brake cyl.)
- h = Connection for brake line rear axle (wheel-brake cyl.)
- V = Brake line to brake master cylinder (brake circuit for front axle)
- H = Brake line to brake master cylinder (brake circuit for rear axle)

Caution

Under no circumstances may the hexagon-socket-head cap screws or the Torx screws be loosened. After loosening, the brake circuits can no longer be got free of leaks or can no longer be bled.

Danger!

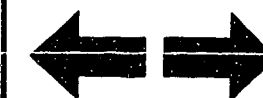
H9

Test with ABS tester
Porsche 928 S



H10

Test with ABS tester
Porsche 928 S



TEST STEP 41

Operation:

Program-selector switch position

20

Additional operations:

- Let the engine run.
- Switch on left-hand and right-hand brake rollers.
- Select rear axle with key RA.
- Press brake pedal until instruments of dynamic brake analyzer indicate 2000 N (200 kgf)
Brake pedal force must not be changed throughout the entire measuring procedure.
- Right-hand reading may differ by no more than 500 N (50 kgf) from the left-hand reading.
- Press illuminated key until test is completed (approx. 10 seconds).
- Read off reading.
- Release brake pedal and illuminated key (follow the sequence of operations so that the vehicle does not jump out of the rollers).

Reading:

Instruments on dynamic brake analyzer:

Reading moves to a value

below 1500 N
(150 kgf)

If reading O.K., continue testing with next test step.

Trouble-shooting:

- Lamp 2 (red) must not light up.
- Repeat the test twice and make sure that the braking force is not changed during the testing procedure.

Continued on H 13

Testing:

Component:

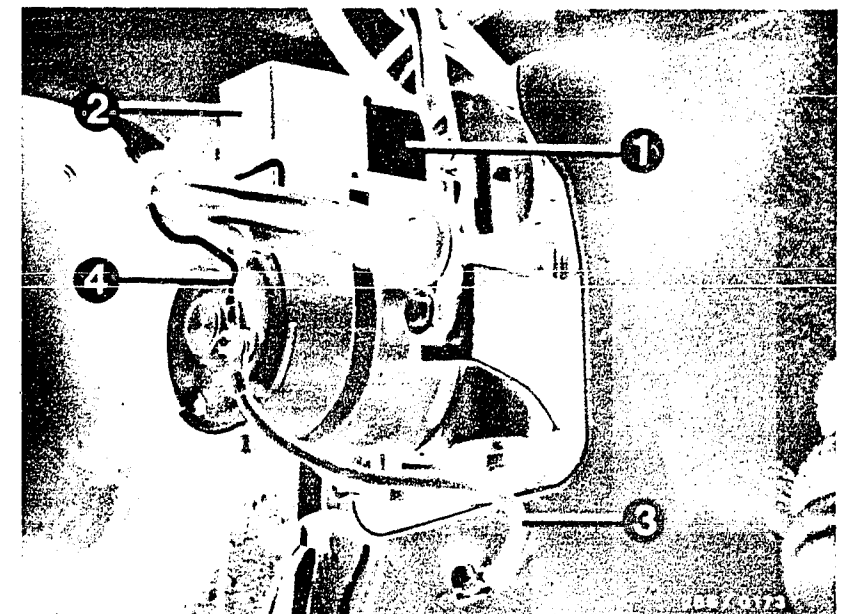
Hydraulic modulator

Operation:

Pressure reduction in rear axle brake lines

Malfunction:

Braking force reading greater than 1500 N



1 = Valve relay

2 = Return-pump relay

l = Connection for brake line front left (wheel-brake cyl.)

r = Connection for brake line front right (wheel-brake cyl.)

h = Connection for brake line rear axle (wheel-brake cyl.)

V = Brake line to brake master cylinder (brake circuit for front axle)

H = Brake line to brake master cylinder (brake circuit for rear axle)

Caution

Under no circumstances may the hexagon-socket-head cap screws or the Torx screws be loosened. After loosening, the brake circuits can no longer be got free of leaks or can no longer be bled.

Danger!

H11

Test with ABS tester

Porsche 928 S



H12

Test with ABS tester

Porsche 928 S



TEST STEP 41

Trouble-shooting (continued)

- Rest of the brake system OK? Properly bled?
Brake-line connections not leaking? Brake pads OK?
Brake pads must not be "glazed". Brake discs OK?
Brake must "grip" well.
Brake master cylinder and wheel-brake cylinder OK?
Wheel-brake cylinder and brake pads must move freely.
Clean if necessary.
- Check ground terminals on pump motor and vehicle body.
- Check positive terminal on pump motor.
- Replace hydraulic modulator.

H13

Test with ABS tester

Porsche 928 S



TEST STEP 42

Operation:

Program-selector switch position

21

Additional operations:

- Let engine run.
- Switch on both brake rollers.
- Select rear axle with key RA.
- Press brake pedal until instrument on dynamic brake analyzer indicates 2000 N (200 kgf)
- Brake pedal force must not be changed throughout the entire test procedure.
- Press illuminated key until test is completed (approx. 10 seconds).
- Read off left-hand reading.
- Release brake pedal and illuminated key (follow sequence of operations so that vehicle does not jump out of rollers).

Reading:

Instruments on dynamic brake analyzer:

Reading drops to an intermediate value and then rises to

max. 1800 N
(max. 180 kgf).

If reading O.K., continue testing with next test step.

Trouble-shooting:

- Repeat the test twice and make sure that the braking force is not changed during the testing procedure (let the engine run).

Testing:

Component:

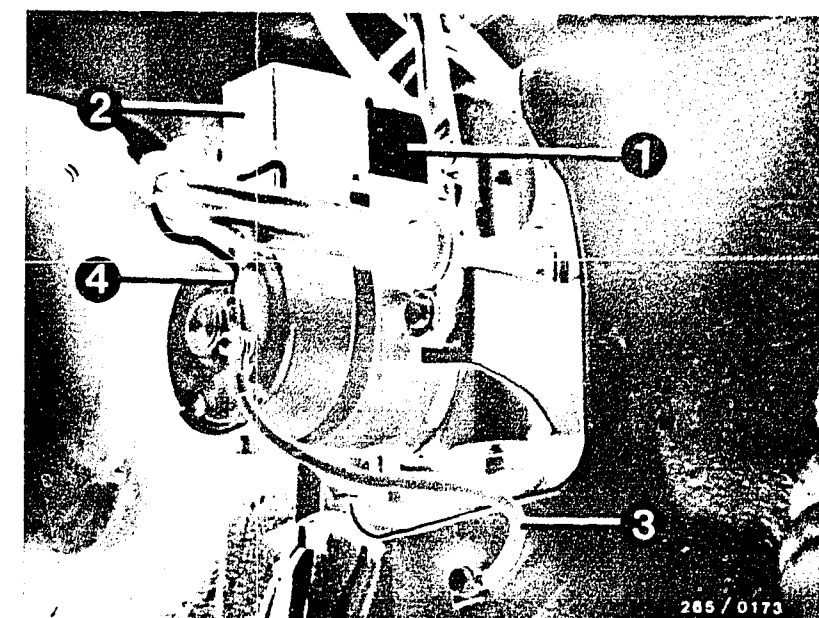
Hydraulic modulator

Operation:

Pressure buildup in rear-axle brake lines

Malfunction:

Braking force greater than 1800 N



- 1 = Valve relay
- 2 = Return-pump relay
- l = Connection for brake line front left (wheel-brake cyl.)
- r = Connection for brake line front right (wheel-brake cyl.)
- h = Connection for brake line rear axle (wheel-brake cyl.)
- V = Brake line to brake master cylinder (brake circuit for front axle)
- H = Brake line to brake master cylinder (brake circuit for rear axle)

Caution

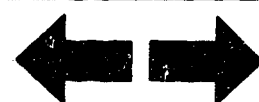
Under no circumstances may the hexagon-socket-head cap screws or the Torx screws be loosened. After loosening, the brake circuits can no longer be got free of leaks or can no longer be bled.

Danger!

Continued on H 16

H14

Test with ABS tester
Porsche 928 S



H15

Test with ABS tester
Porsche 928 S



TEST STEP 42

Trouble-shooting (continued)

- Rest of the brake system OK? Properly bled?
Brake-line connections not leaking? Brake pads OK?
Brake pads must not be "glazed". Brake discs OK?
Brake must "grip" well.
Brake master cylinder and wheel-brake cylinder OK?
Wheel-brake cylinder and brake pads must move freely.
Clean if necessary.
- Check ground terminals on pump motor and vehicle body.
- Check positive terminal on pump motor.
- Replace hydraulic modulator.



TEST STEP 43

Operation:

Program-selector switch position

22

Additional operation:

- Let engine run.
- Switch on both brake rollers.
- Select rear wheels with key RA.
- Press brake pedal until instruments of dynamic brake analyzer indicate 2000 N (200 kgf).
- Pedal brake force must not be changed throughout the entire test procedure.
- Press illuminated key until braking force rises again (after approx. 10 seconds).
- Make reading.
- Release brake pedal and illuminated key (follow sequence of operations so that vehicle does not jump out of rollers).

Reading:

Instruments on dynamic brake analyzer:

After twice pressure reduction without return pump the pump is switched on briefly.

Brake pedal comes back slightly when pump switches on. Then braking force reading must drop

below 600 N (60 kgf).

The test specification is indicated only for approx. 2.5 seconds and then rises again to the full braking force.

If reading O.K., the test with ABS tester is completed. As a final check, perform a road test: With the engine running, the indicator lamp must go out. Drive at least 30 km/h. Indicator lamp must not come on again.

Testing:

Component:

Hydraulic modulator

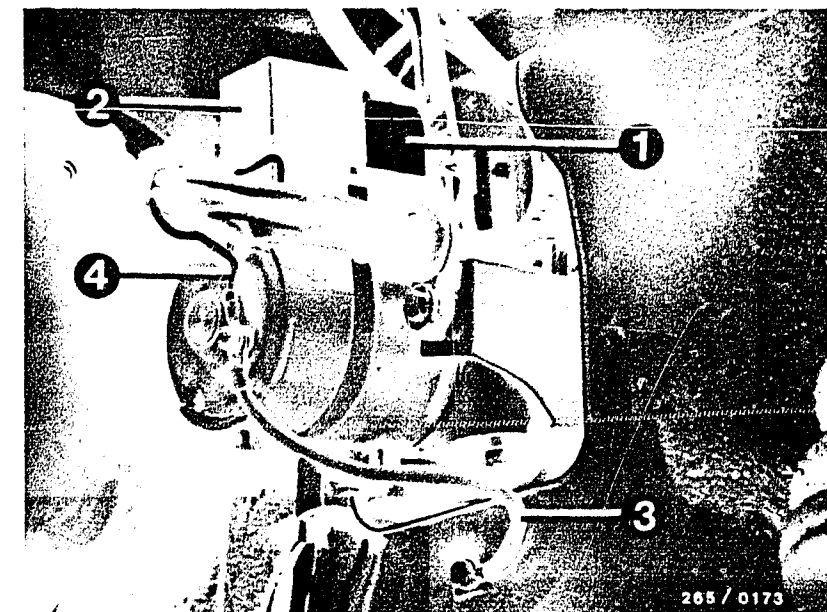
Operation:

Pump delivery

Brake circuit for rear axle

Malfunction:

Braking force reading greater than 600 N



1 = Valve relay

2 = Return-pump relay

l = Connection for brake line front left (wheel-brake cyl.)

r = Connection for brake line front right (wheel-brake cyl.)

h = Connection for brake line rear axle (wheel-brake cyl.)

V = Brake line to brake master cylinder (brake circuit for front axle)

H = Brake line to brake master cylinder (brake circuit for rear axle)

Caution

Under no circumstances may the hexagon-socket-head cap screws or the Torx screws be loosened. After loosening, the brake circuits can no longer be got free of leaks or can no longer be bled.

Danger!

Trouble-shooting:

- Repeat test twice and make sure that braking force is not changed during testing.

Continued on H19

H17

Test with ABS tester

Porsche 928 S



H18

Test with ABS tester

Porsche 928 S



TEST STEP 43

Trouble-shooting (continued)

- Rest of the brake system OK? Properly bled?
Brake-line connections not leaking? Brake pads OK?
Brake pads must not be "glazed". Brake discs OK?
Brake must "grip" well.
Brake master cylinder and wheel-brake cylinder OK?
Wheel-brake cylinder and brake pads must move freely.
Clean if necessary.
- Check ground terminals on pump motor and vehicle body.
- Check positive terminal on pump motor.
- Replace hydraulic modulator.

H19

Test with ABS tester

Porsche 928 S

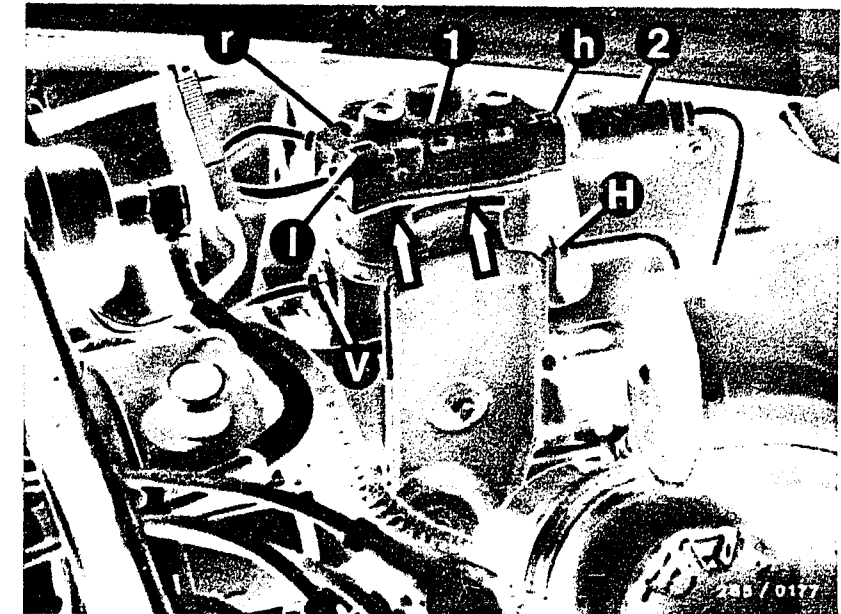


12. REPLACEMENT OF HYDRAULIC MODULATOR

(Applies only to test steps 33...37 and 40...43)

Important information on replacing the hydraulic modulator

- For safety reasons, the hydraulic modulator must not be repaired, but the complete unit must be replaced.
Exceptions to this are the return-pump relay and the valve relay. Both relays may be replaced.
- Apart from the brake line connections, it is not permissible to loosen any screws on the hydraulic modulator. Under no circumstances may the hexagon-socket-head cap screws/torx screws be loosened. After loosening, it is no longer possible to get the brake circuits leak-tight, or the brake circuits can no longer be bled.
Danger!
- Check the hydraulic modulator and brake-line connections for leaks by means of a visual examination. If brake fluid is escaping, tighten the brake-line connections (12 ... 16 Nm) or replace, or replace the hydraulic modulator.



1 = Hydraulic modulator
2 = Load-sensing valve
Arrows = Joints

Continued on J3/J4

J1

Replacement of hydraulic modulator
Porsche 928 S



J2

Replacement of hydraulic modulator
Porsche 928 S



Replacement of hydraulic modulator (continued)

Pay particular attention to the joints identified by arrows (top picture). On the base of the hydraulic modulator there is a vent hole to the pump pistons. A slight escape of brake fluid at this point is possible.

A complaint is only justified if, after pressing the brake pedal several times, a pool of brake fluid is formed under the hydraulic modulator.

- When removing and installing the brake lines, make sure that the lines are marked in accordance with the markings on the hydraulic modulator and that they are not mixed up when re-connecting (e.g. the connection of the hydraulic modulator marked "L" must be connected to the front left wheel-brake cylinder).

• Markings on hydraulic modulator:

l = Connection for brake line front left (wheel-brake cylinder)
r = Connection for brake line front right (wheel-brake cylinder)
h = Connection for brake line of rear axle

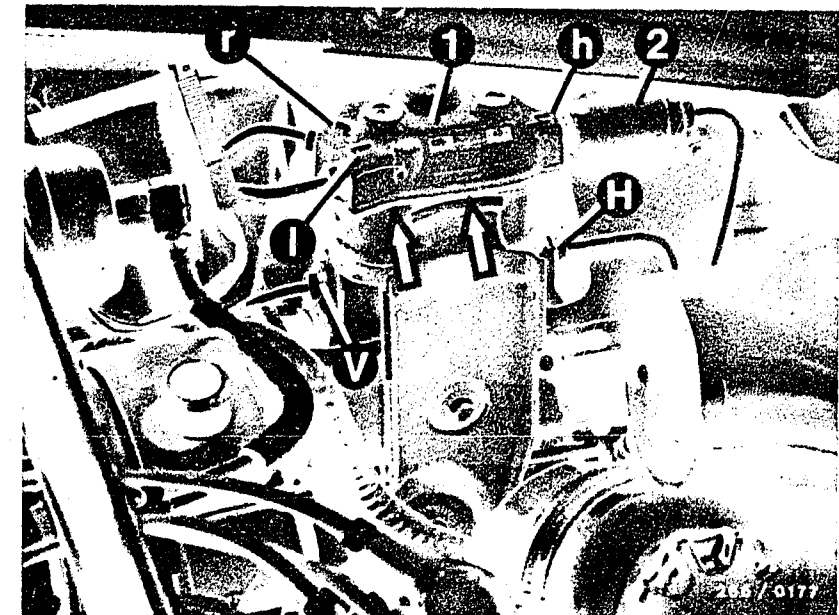
V = Front axle brake circuit from brake master cylinder
H = Rear axle brake circuit from brake master cylinder

- To remove, the left-hand front wheel must be taken off.

Removal

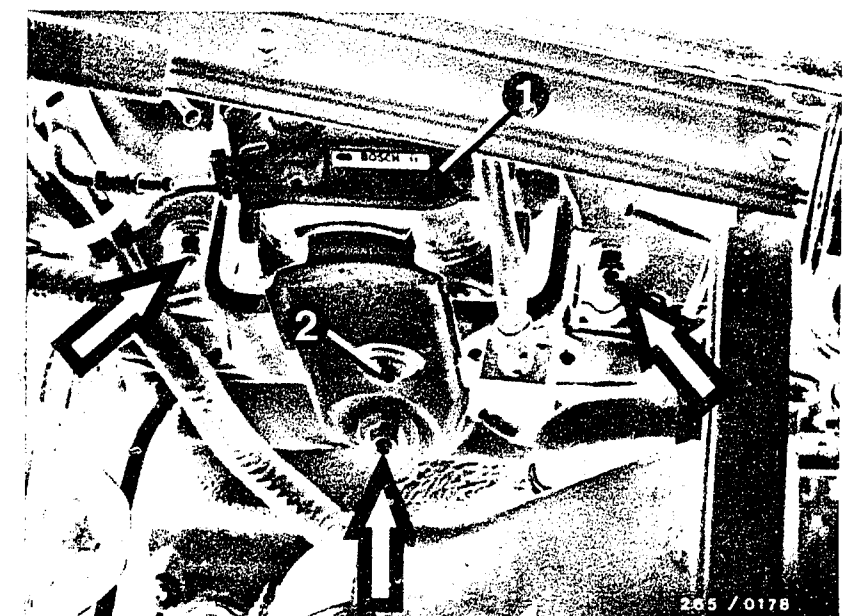
- Switch off ignition and loosen battery ground cable at bodywork.
- Remove left-hand connecting hose to air filter. Loosen supply reservoir for servo steering at bracket (leave hoses connected). Remove ignition cable from ignition coil.
- For loosening and tightening the brake lines, use only the specified double-head box wrench 9 x 11 mm.
- Mark brake lines and loosen from hydraulic modulator. Loosen load-sensing valve from hydraulic modulator.
- Catch brake fluid and do not bring into contact with hands or clothing or paintwork.
- Immediately seal brake lines and connections with dummy plugs.

Continued on J5/J6



1 = Hydraulic modulator
2 = Load-sensing valve
Arrows = Joints

1 = Hydraulic modulator
2 = Fastening screws
Arrows = Self-locking nuts



J3

Replacement of hydraulic modulator
Porsche 928 S



J4

Replacement of hydraulic modulator
Porsche 928 S

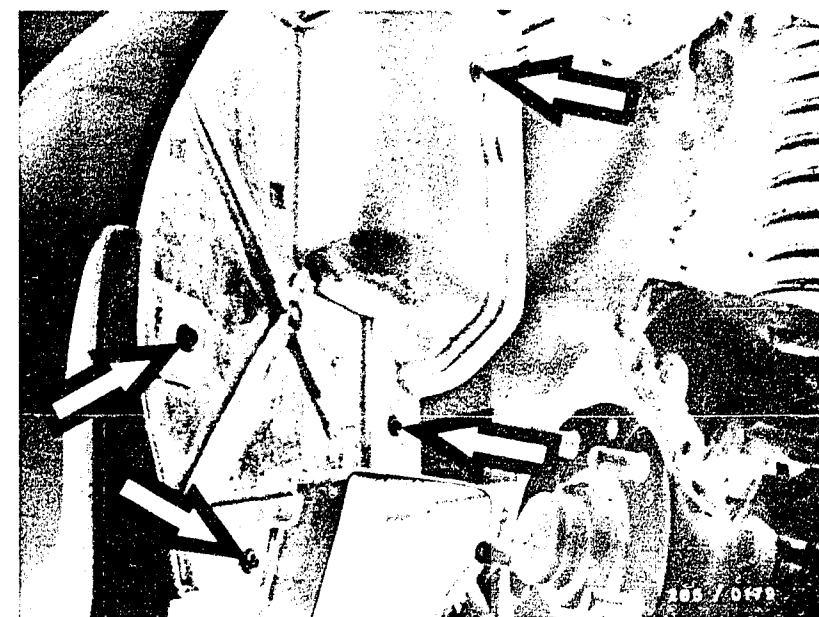


Replacement of hydraulic modulator (continued)

- Loosen fastening screw for hydraulic modulator and self-locking nuts (3 pieces) from bracket.
- Take off left-hand front wheel.
- Unscrew wheelhouse seal.
- Unscrew hood from hydraulic modulator and take off.
- Loosen strain relief and take off plug.
- Loosen ground lead on pump motor.
- Loosen hexagon screws from bracket and take out hydraulic modulator

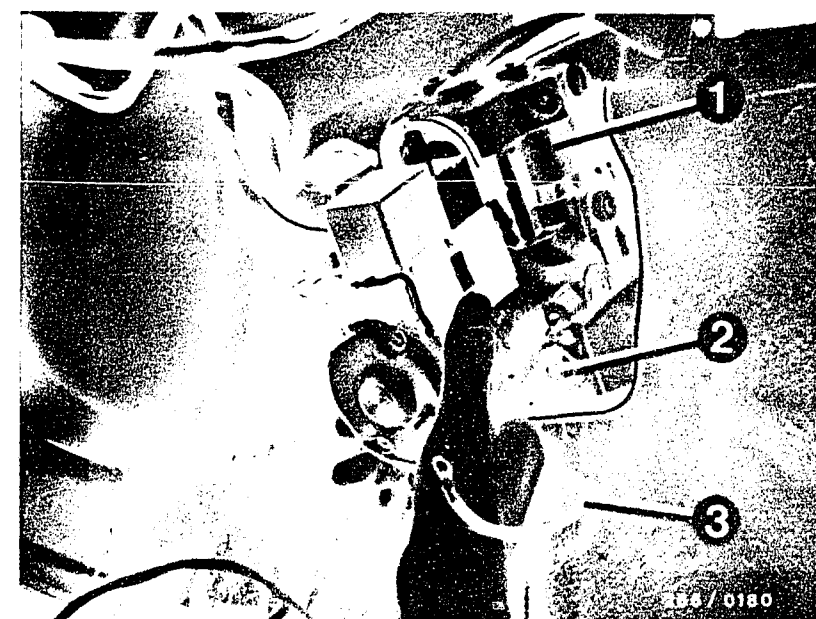
Installation

- Insert bracket for hydraulic modulator in wheelhouse and tilt downward on wheel side.
- Insert hydraulic modulator from wheel side into the bracket and screw in the 2 fastening screws, but do not tighten. Insert cable holder under the right-hand fastening screw.
- Secure bracket on wheel house with 3 self-locking nuts. If necessary, use new nuts.
- Mount hydraulic modulator in bracket. Tighten all 3 fastening screws.
- Connect ground lead to pump motor. Connect 12-pin plug and secure with strain relief.
- Mount hood with screw on hydraulic modulator
- Connect brake lines, in accordance with markings, as well as load-sensing valve to hydraulic modulator.
- Observe tightening torque for brake line connections on hydraulic modulator: 12 ... 16 Nm.
- Bleed brake system and check for leaks.
- Mount wheelhouse cover, front wheel, supply reservoir for servo steering, ignition cable on ignition coil and intake hose. Secure battery ground cable on body.
- Test ABS completely with tester.



Arrows = Fastening screws for wheelhouse cover

- 1 = Hydraulic modulator
- 2 = Fastening point on bracket
- 3 = Ground lead from pump motor



J5

Replacement of hydraulic modulator
Porsche 928 S



J6

Replacement of hydraulic modulator
Porsche 928 S



Technical Bulletin

Only for use within the Bosch organization. No to be communicated to any third party.

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NO REPAIRS PERMITTED/
MAXIMUM ALLOWABLE SHELF LIFE
FOR ABS HYDRAULIC MODULATORS

VDT-I 265/102 En

7.1984

supersedes edition 1.1980

1. No repairs permitted

The passenger-car ABS is a piece of safety equipment. As a result of unauthorized interference with the ABS components there is the danger that the efficient operation of the ABS system will be adversely affected.

We would point out, therefore, that the hydraulic modulator must under no circumstances be repaired. For safety reasons it must be exchanged as a complete unit.

It is only permitted to exchange the motor and valve relay. All other screws and plugs must not be loosened.

2. Maximum allowable shelf life

The maximum allowable shelf life for hydraulic modulators is 2 years, reckoned from the production date (FD) given on the product. When the maximum shelf life is reached, the hydraulic modulator must be subjected to a functional check.

This functional check can only be performed in the specialist department of Robert Bosch GmbH. Once checked, the hydraulic modulators are identified with L and new FD. After a further 2 years, i.e. after a total of 4 years shelf life, it is necessary for all rubber and plastic parts to be exchanged at the factory.

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Technical Bulletin

Porsche 928 S



Service workshops outside Germany should send the hydraulic modulators to:

Robert Bosch GmbH
KH/LAV 2 - Auspackraum
z. W. an K1 / VAK 2
Auf der Breit 4

7500 Karlsruhe 41.

The hydraulic modulators should be sent in to us postage-paid. On the enclosed delivery note please quote this Technical Bulletin.

The functional check is performed subject to payment.

Published by:

Robert Bosch GmbH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.



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Technische Mitteilung

Porsche 928 S



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Anfragen außerhalb der Bundesrepublik Deutschland sind
an die jeweilige RG/AV zu richten.

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Technische Mitteilung

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Technische Mitteilung

Nur zum internen Gebrauch. Weitergabe an Dritte nicht gestattet.

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**INSTANDSETZUNGSVERBOT /
HÖCHSTZULÄSSIGE LAGERZEIT
FÜR ABS-HYDROAGGREGATE**

VDT-I 265/102 De

7.1984

ersetzt Ausgabe 1.1980

1. Reparaturverbot


Beim PKW-ABS handelt es sich um eine Sicherheitseinrichtung. Durch unzulässige Eingriffe in die ABS-Komponenten besteht die Gefahr, daß die einwandfreie Funktion der ABS-Anlage beeinträchtigt wird.

Wir weisen deshalb darauf hin, daß das Hydroaggregat unter keinen Umständen instandgesetzt, sondern aus Sicherheitsgründen nur komplett ausgetauscht werden darf.

Zulässig ist nur der Austausch von Motor- und Ventilrelais. Alle übrigen Schrauben und Verschlußstopfen dürfen nicht gelöst werden.

2. Höchstzulässige Lagerzeit

Die höchstzulässige Lagerzeit für Hydroaggregate beträgt, gerechnet ab dem auf dem Erzeugnis angegebenen Fertigungsdatum (FD), 2 Jahre. Bei Erreichen der Höchstlagerzeit muß das Hydroaggregat einer Funktionsüberprüfung unterzogen werden.

Diese Funktionsüberprüfung kann nur in der Fachabteilung der Robert Bosch GmbH durchgeführt werden. Die überprüften Hydroaggregate werden mit  und neuem FD gekennzeichnet. Nach weiteren 2 Jahren, also insgesamt

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4 Jahren Lagerzeit, ist ein Austausch aller Gummi- und Kunststoffteile im Werk notwendig.

Deutsche Kundendienststellen senden die Hydroaggregate an:

Robert Bosch GmbH
Abt. K1 / VAK 2
Robert-Bosch-Straße
7141 Schwieberdingen

Kundendienststellen aus den übrigen Ländern bitten wir, die Hydroaggregate an:

Robert Bosch GmbH
KH/LAV 2 - Auspackraum
z. W. an K1 / VAK 2
Auf der Breit 4
7500 Karlsruhe 41

einzusenden.

Die Hydroaggregate sind kostenfrei für uns einzusenden. Auf dem beigegeführten Lieferschein nehmen Sie bitte Bezug auf diese Technische Mitteilung.

Die Funktionsüberprüfung wird kostenpflichtig durchgeführt.

Verantwortlich:

Robert Bosch GmbH
Geschäftsbereich KH
Technischer Kundendienst (KH/VKD 2)

Anfragen außerhalb der Bundesrepublik Deutschland sind an die jeweilige RG/AV zu richten.

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